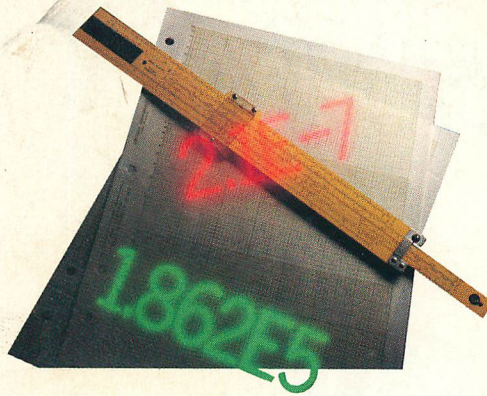


FOR IBM PERSONAL COMPUTER USERS

# TECH JOURNAL

## **SIGNIFICANT FIGURES, I**

*Floating-point addition and subtraction on the IBM PC*



**RELAY: POWERFUL COMMUNICATIONS**

**TWO OBJECT-MODULE LIBRARIANS**

**THE TRANSITION FROM BASIC TO C**

**IBM PC PASCAL FORMATTERS**

**MULTITASKING WITH MULTILINK**





# BORLAND IN

If you're programming . . . Turbo Pascal™  
makes it easier and much faster  
. . . *from start to finish.*

Now . . . with the advent of Turbo Pascal™, Pascal is a language for everyone who programs. It comes with a built-in editor, occupies only 35K of your precious memory and is menu-driven for true, programming ease.

Whether you're a professional software developer, a student, or someone who just enjoys programming for its own sake, Turbo Pascal™ is designed for you.

**"Turbo is much better  
than the Pascal IBM sells."**

Jerry Pournelle, *Byte*, July 1984

**"If you have the slightest  
interest in Pascal . . . buy it."**

Bruce Webster, *Softalk IBM*, March 1984

- Automatic Overlays
- A Full-Screen Editor
- Full Heap Management — via dispose procedure
- Full Support of Operating System Facilities



**\$49.95**

- Windowing (IBM PC, XT, jr. or true compatibles)
- Color, Sound and Graphics Support (IBM PC, XT, jr. or true compatibles)
- Optional 8087 Support (Available at an additional charge. Even if you haven't yet added an 8087 math chip to your 16 bit machine, you can purchase this now and be ready for the future. Both versions will be on your disk.)
- No License Fees. You can sell the programs you write with Turbo Pascal without extra cost.
- Free Spreadsheet Included. Yes. We include Microcalc . . . the sample spreadsheet written with Turbo Pascal. You can study the source code to learn how a spreadsheet is written . . . it's right on the disk.

**YOU CAN ORDER YOUR COPY OF SIDEKICK™ OR TURBO PASCAL™ TODAY!**

For Visa and MasterCard orders call Toll Free 1-800-255-8008

in California 1-800-742-1133

(lines open 24 hours, 7 days a week) Dealer and Distributor Inquiries Welcome 408-438-8400

**CHOOSE HERE:** (Please add \$5 shipping and handling per copy for U.S. orders)

\_\_\_ Sidekick™ \$49.95 plus \$5  
(Available only for the IBM PC, XT, Jr. and Compatibles)

Please specify computer \_\_\_\_\_

**Turbo Pascal™**

My system is: 8 bit \_\_\_\_\_ 16 bit \_\_\_\_\_

Operating System: CP/M 80 (Z80 only, no 8080) \_\_\_\_\_

CP/M 86 \_\_\_\_\_ MSDOS \_\_\_\_\_ PC DOS \_\_\_\_\_

Computer: \_\_\_\_\_ Disk Format: \_\_\_\_\_

\_\_\_ Turbo Pascal \$49.95 plus \$5

\_\_\_ Turbo Pascal with 8087 support  
\$89.85 plus \$5

(California residents add 6% sales tax. Outside U.S.A. add \$15 shipping and handling per copy. If outside of U.S.A., payment must be by bank draft payable in the U.S. and in U.S. dollars. Sorry, no C.O.D. or purchase orders.) **PG**

\$ \_\_\_\_\_ Total enclosed

Check \_\_\_\_\_ Money Order \_\_\_\_\_

VISA \_\_\_\_\_ MasterCard \_\_\_\_\_

Card # \_\_\_\_\_

Expiration Date \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_



**BORLAND  
INTERNATIONAL**

Borland International  
4113 Scotts Valley Drive  
Scotts Valley, California 95066  
408/438-8400  
TELEX 172373





# INTERNATIONAL

Whenever you're using your computer . . . *from start to finish* of your session . . . Sidekick™ will be there . . . ready to serve. And it's as lightning-fast and compact as only Borland knows how to make it.

## SIDEKICK

THE SUPER ORGANIZER



ALWAYS JUST A  
KEYSTROKE  
AWAY . . .

Introductory Offer

**\$49.95**



Here's Sidekick in action. That's Lotus 1-2-3 running underneath. In the Sidekick Notepad you can see data that's been imported from the Lotus screen. On the upper right, that's the Sidekick Calculator.

There's a notepad that has a full-screen editor that can time and date stamp your notes, and then save them to disk. You can even pull information into the notepad directly from the screen of your underlying software.

Suppose you're working with a spreadsheet, and you suddenly have an important idea. Just hit the button, a window opens, you write the note and hit the button again. You're right back where you left off in the spreadsheet.

Need to make a phone call? Whether the number is in an existing database, your own Sidekick phone directory or you've just typed it on the screen . . . place the cursor next to the number, hit the keystroke, and Sidekick dials for you!\*

WHETHER YOU'RE RUNNING  
1-2-3, WORDSTAR, dBASEII  
OR WHATEVER . . .

JUST A KEYSTROKE AND  
A SIDEKICK WINDOW OPENS . . .

- A CALCULATOR
- A NOTEPAD
- AN APPOINTMENT CALENDAR
- AN AUTO DIALER
- A PHONE DIRECTORY
- AN ASCII TABLE
- AND MUCH MORE

ALL AT ONCE . . . OR ONE AT A TIME.  
ANYWHERE ON THE SCREEN  
YOU LIKE.

ANOTHER KEYSTROKE, AND  
YOU'RE RIGHT WHERE YOU LEFT  
OFF IN YOUR ORIGINAL PROGRAM!  
(you never really left!)

There's lots more, too. You can move the Sidekick windows anywhere on the screen you like. And you can have as many on screen at a time as you need. There's even an on-line help window for each of Sidekick's features.

We designed it because we needed it. If you've ever been writing a report and needed to do a quick calculation, or jot down a note, then you need Sidekick, too.

\*Works with Hayes Smartmodem and compatibles.

Circle 23 on inquiry card.

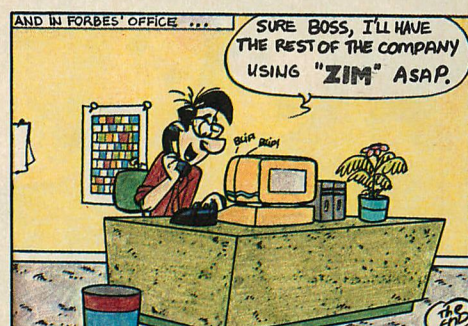
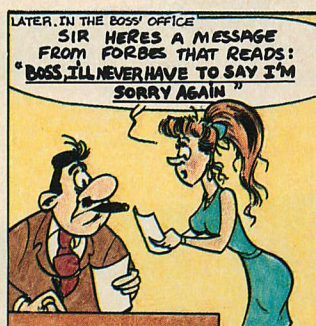
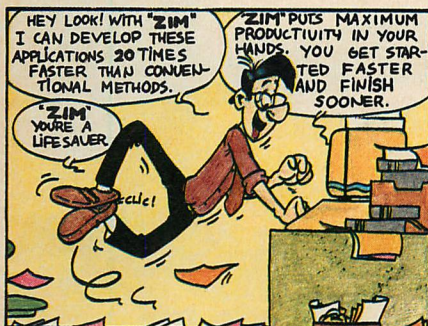
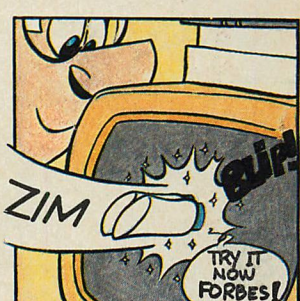
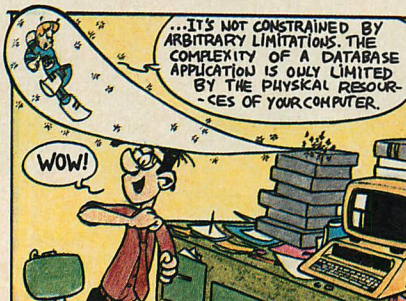
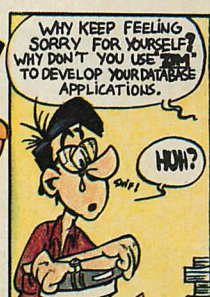
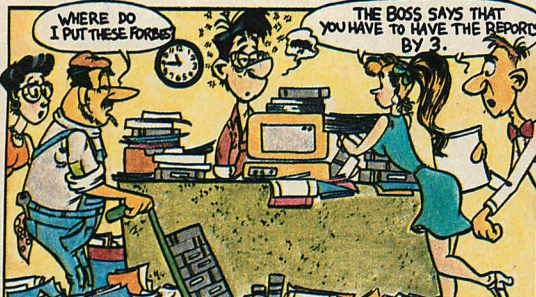




From start to finish  
The winner is . . .



**ZIM™**  
means never having  
to say you're sorry!



Simply put, **ZIM** is the most modern, comprehensive and efficient 4th Generation Database Applications Development Language available.

**ZIM's** Entity-Relationship model gives you the most powerful database design and data manipulation



capabilities with unlimited capacity for growth. You get exceptional ease of use because **ZIM** integrates the functions of query, update, forms painting and manipulation, reporting and data dictionary into a uniform and elegant

English-like command language.

**ZIM** puts maximum productivity in your hands. You get started faster and finish sooner. And of course, you will be backed by top notch support from Zanthé — the company that understands what "real" database application development is all about.

You'll never have to say "sorry" to yourself again.



**ZANTHE**

INFORMATION INC.

1785 Woodward Drive

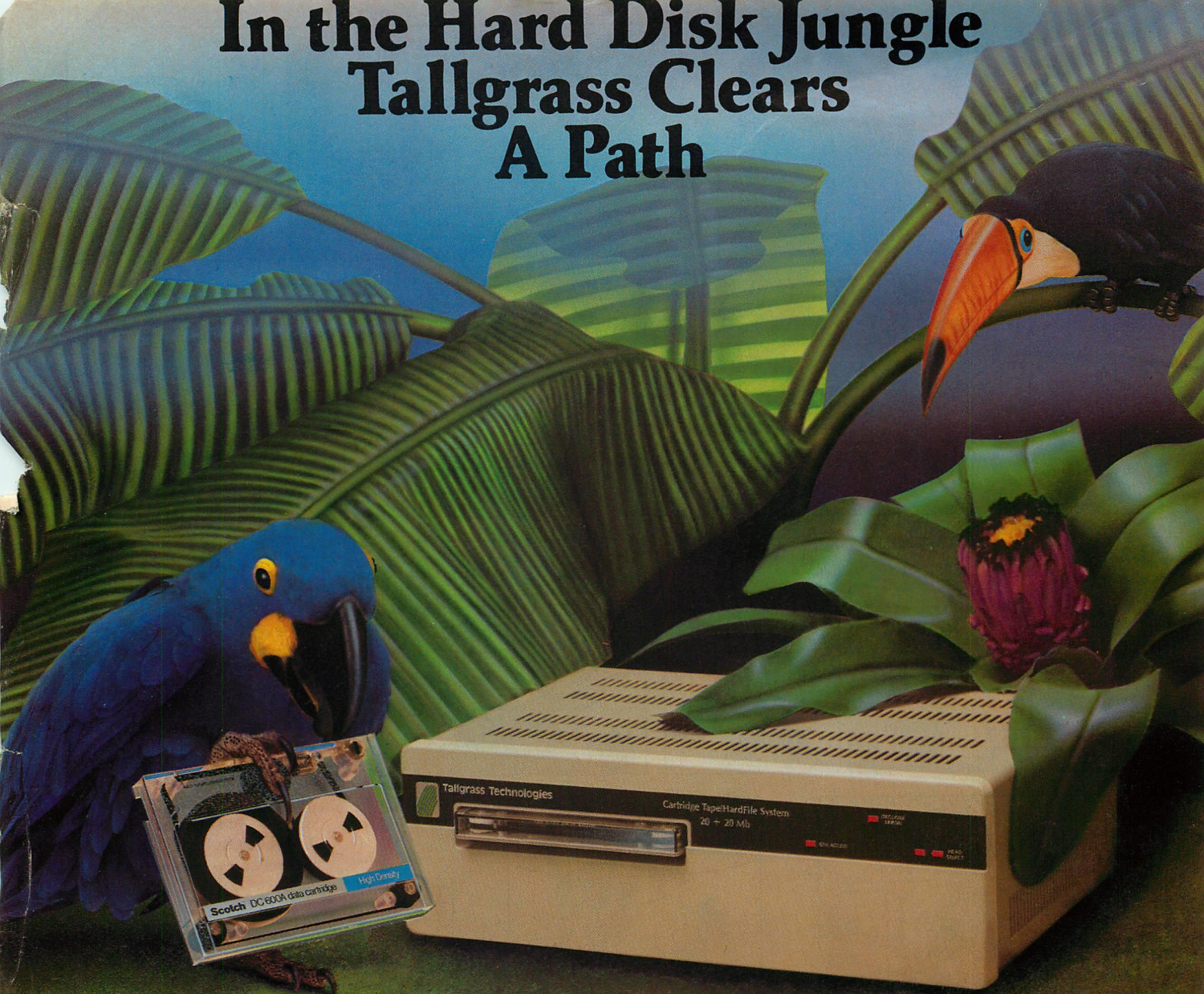
Ottawa, Ontario K2C 0R1 (613) 727-1397

CIRCLE NO. 148 ON READER SERVICE CARD

**ZIM** is available on most personal computers under the MS-DOS operating system. A multi-user version of **ZIM** is available for the QNX and UNIX multi-user operating systems



# In the Hard Disk Jungle Tallgrass Clears A Path



In today's hard disk jungle, Tallgrass clears a path by offering high performance, integrated mass storage solutions for the IBM® PC/XT, the T.I. Professional and related computers.

## TALLGRASS INNOVATIVE FEATURES

**MASS STORAGE SYSTEMS** with formatted HardFile™ capacities of 6, 12, 20, 35 and 70 Mb, all with built-in tape backup.

**CONVENIENT INTEGRAL TAPE BACKUP SYSTEM** allows rapid tape "image" streaming, or incremental file-by-file backup and restore on ANSI standard inexpensive data cartridges, instead of the usual floppies, video cassettes, or low-capacity removable Winchester devices.

**NETWORK READY** and fully compatible with networks such as PCnet® and EtherShare™.

**HIGH RELIABILITY** with dual directory and read-after-write verify options. A dedicated landing zone, where the read/write heads reside when the disk is idle, provides data protection during powerdowns and transportation.

Follow the Tallgrass path to your local computer dealer and watch your personal computer transform into a powerful data processing system.

Available from COMPUTERLAND®, Entré® Computer Centers, MicroAge® Computer Stores and other participating computer dealers.

## New! IBM-XT Cartridge Tape Backup

World Headquarters: Tallgrass Technologies Corp. / 11100 W. 82nd St.  
Overland Park, KS 66214 / 913/492-6002 / Telex: 215406 TBYT UR

Canadian Headquarters: Tallgrass Technologies (Canada), 1775 Meyerside Drive  
Mississauga, Ontario, Canada L4V 1H2 / 416 / 673-3244

European Distributor: CPS Computer Group, LTD  
Birmingham, England B276BH / (021) 7073866

Australian Headquarters: Tallgrass Technologies (Australia) / Five Dock Plaza,  
Suite 12/50 Great North Road / Five Dock / Sydney, N.S.W. 2046 / (02) 712-2010

CIRCLE NO. 234 ON READER SERVICE CARD



**Tallgrass  
Technologies**  
Corporation

IBM® is a registered trademark of International Business Machines Corp.

PCnet® is a trademark of Orchid Technology

EtherShare™ is a registered trademark of 3Com Corp.

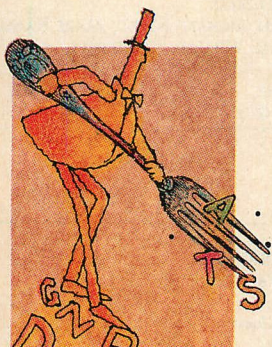


FOR IBM PERSONAL COMPUTER USERS

# TECH JOURNAL

ARTICLES

Volume 2, Number 4  
October 1984



22

## THE WELL-FORMATTED PASCAL

**STEVEN ARMBRUST and TED FORGERON** / Prettying up Pascal into professional-looking code is not all formatters can do: they can increase overall productivity.

22

## DOS SHELLS CONTINUED

**ARTHUR A. GLECKLER** / Three more efforts to cover up PC-DOS confusion

36

## SIGNIFICANT FIGURES, I

**ROBERT GRAY** / The first of three articles on floating-point arithmetic

54

## MULTITALENTED

**J. ERIC ROSKOS** / Adding multitasking capability to PC-DOS with MultiLink

64

## CHECKING OUT THE LIBRARIANS

**KURYAN THOMAS** / Two products that create libraries of object modules

80

## INSTANT RELAY

**AUGIE HANSEN** / A powerful, feature-packed entrant in the PC communications race

94

## BASIC TO C

**ERNEST TELLO** / Tools for translating code from one language to another

117

## A SCREEN OF MANY COLORS

**DON AWALT** / An assembly language routine to expand character color options

145

## INSIDE 1-2-3 WORKSHEET FILES

**WILLIAM F. SHARPE** / Exploring the structure of worksheet files in Lotus 1-2-3

155

## BASIC ELEGANCE

**RON BAUMAN** / Loading BASIC-callable subroutines the fast, easy, and transparent way

181

## DEPARTMENTS

Directions **5**  
Letters **12**  
Book Reviews **195**  
Legal Brief **197**  
Tech Releases **202**  
Calendar **218**

## TECH NOTEBOOKS

24: Talking to Your Mouse from Turbo Pascal **63**  
25: MORE Without Redirection **148**  
26: BASIC String Manipulation **193**

## PRODUCTS

Tech Book **208**  
Tech Mart **213**  
Product Index **215**  
Advertisers' Index **217**

80





# 3740

Diskette Exchange Software

Access IBM data processing equipment through the 8" diskette and avoid the problems of serial communication.

By adding an 8" drive to your PC and using our **REFORMATTER®** Conversion Software, you can exchange diskettes with IBM's 3741, 3742, 3747, 5110/20, Series 1, System 3/32/34/36/38/360/370 and 43xx and non IBM machines that read and write the IBM 3740 diskette.

Available under PC-DOS or CP/M-86 at \$350 from MicroTech Exports, 467 Hamilton Avenue, Palo Alto, CA 94301. Tel: 415-324-9114 TWX: 910-370-7457: MUH-ALTOS.

CIRCLE NO. 155 ON READER SERVICE CARD

## OPT-TECH SORT™

### SORT/MERGE program for IBM-PC & XT

Now also sorts dBASE II files!

- Written in assembly language for **high performance**  
Example: 4,000 records of 128 bytes sorted to give key & pointer file in 30 seconds. **COMPARE!**
- Sort ascending or descending on up to nine fields
- Ten input files may be sorted or merged at one time
- Handles variable and fixed length records
- Supports all common data types
- Filesize limited only by your disk space
- Dynamically allocates memory and work files
- Output file can be full records, keys or pointers
- Can be run from keyboard or as a batch command
- Can be called as a subroutine to many languages
- Easy to use, includes on-line help feature
- Full documentation — sized like your PC manuals
- **\$99** — VISA, M/C, Check, Money Order, COD, or PO  
Quantity discounts and OEM licensing available

To order or to receive additional information write or call:

### OPT-TECH DATA PROCESSING

P.O. Box 2167 Humble, Texas 77347  
(713) 454-7428

Requires DOS, 64K and One Disk Drive

CIRCLE NO. 179 ON READER SERVICE CARD

# TECH JOURNAL

VOL. 2, NO. 4

**Publisher:** NEWTON BARRETT

#### Editorial

Editor: WILL FASTIE

Managing Editor: MARJORY SPRAYCAR

Technical Editors: JULIE ANDERSON, SUSAN GLINERT-COLE

Senior Copy Editor: SUSAN HOLLY

Copy Editor: BARBARA TILLY

Research Assistant: ARTHUR A. GLECKLER

Contributing Editors: RAY DUNCAN, RICHARD FOARD, AUGIE HANSEN,

THOMAS V. HOFFMANN, SOL LIBES, WILLIAM H. MURRAY,

MAX STUL OPPENHEIMER,

Editorial Secretary: DIANA L. CAREY

Editorial Assistant: CAROLE AUTENZIO

#### Art & Production

Art Director: NANCY LEPOW

Assistant Art Director: JANE FREY

Art Assistant: SANDRA RAY

#### Advertising Sales

Assistant to Publisher: JULIE HENDERSON

Advertising Coordinator: SHERYL PANZER

District Managers:

RITA BURKE, IAN SMITH—East Coast

CAROLINE ANDERSON—Midwest

TED BAHR, HARRIET ROGERS—West Coast

Account Sales Manager: PAULINE SCHERER

Account Representatives:

JAN SCHULTZ—East Coast

JOHN GROGAN—Midwest

BILL BUSH, ARLENE STEADMAN—West Coast

#### Circulation

Subscription Director: CHET KLIMUSZKO

Direct Mail Manager: ERIC A. BERNHARD

Renewal and Billing Manager: SHANE BOEL

Media Manager: ANN PICHETTE

Special Subscription Sales: DANIEL ROSENWEIG

#### Computer Publications Division

General Manager: KEN KOPPEL

Vice President: EILEEN G. MARKOWITZ

Vice President, Circulation: CAROLE MANDEL

Vice President, Licensing and Special Projects: JERRY SCHNEIDER

Vice President, Creative Services: HERBERT STERN

Creative Director: PETER J. BLANK

Editorial Director: JONATHAN D. LAZARUS

Marketing Manager: RONNI SONNENBERG

#### Ziff-Davis Publishing

President, RICHARD P. FRIESE; President, Consumer Magazine Division, ALBERT S. TRAINA; Executive Vice President, Marketing and Circulation, PAUL H. CHOOK, Senior Vice President, PHILLIP T. HEFFERNAN, Senior Vice President, SIDNEY HOLTZ; Senior Vice President, EDWARD D. MUHLFELD, Senior Vice President, PHILIP SINE; Vice President, BAIRD DAVIS; Vice President, GEORGE MORRISSEY; Vice President, RORY PARISI; Vice President, WILLIAM L. PHILLIPS; Treasurer, SELWYN TAUBMAN; Secretary, BERTRAM A. ABRAMS

#### Editorial Office

PC TECH JOURNAL, The World Trade Center, Suite 211, Baltimore, MD 21202. 301-576-0770. The Source ID STY682. CompuServe 74156, 2365.

#### Advertising Offices

(East Coast) PC TECH JOURNAL, One Park Avenue, New York, NY 10016. 212-503-5100.

(Midwest) 180 N. Michigan Avenue, Chicago, IL 60601. 312-346-2600.

(West Coast) 11 Davis Drive, Belmont, CA 94002. 415-594-2290.

#### Subscription Inquiries

PC TECH JOURNAL, P.O. Box 2968, Boulder, CO 80321. Subscription service: 212-503-5300. Back issues: send \$7.00/copy to PC TECH JOURNAL, Box CN, 1914, Morristown, NJ 07960.

PC TECH JOURNAL (ISSN 0738-0194) is published 12 times a year, \$29.97 for one year, \$52.97 for two years, \$69.97 for three years. Additional postage \$12 for Canada & Foreign by Ziff-Davis Publishing Company, One Park Avenue, New York, NY 10016. Application for Second-Class Postage Rates pending at New York, NY 10001. POSTMASTER: Send address changes or subscription inquiries to PC TECH JOURNAL, P.O. Box 2968, Boulder, CO 80321.

PC TECH JOURNAL is an independent journal, not affiliated in any way with International Business Machines Corporation. IBM is a registered trademark of International Business Machines Corp. Entire contents Copyright © 1984 Ziff-Davis Publishing Company. All rights reserved; reproduction in whole or in part without permission is prohibited. Contact Jean Lamensdorf, Manager, Reprints/Rights & Permissions. 212-503-5448. BPA membership (Selected Market Audit Division) applied for October 1983.





# Graphics

*An interview with the editor of a leading computer magazine*

The extent to which graphics on the IBM PC are big business seems to be the extent to which spreadsheets with graphics capabilities are used. Although a number of excellent programs exist for two- and three-dimensional drafting, business charting, and drawing, the graphics capabilities of the PC inhibit such products from taking the market by storm. No one I talk to thinks of the PC as a graphics engine, citing limited processor power and insufficient screen resolution as the basis for their conclusion.

I've been mulling over this fact for some time. I assumed that visiting the big trade shows for computers (NCC, Comdex) would provide some answers—that I would see how well the PC was accepted as a system for graphics applications. In point of fact, I saw very little.

That's when I hit upon the idea of visiting the exposition at SIGGRAPH '84 in Minneapolis. I reasoned that SIGGRAPH, which is perhaps the most prestigious graphics conference in the world, would provide me a perspective on the state of the art in graphics and an opportunity to prowl the show floor looking for PCs.

Now that I'm back, you would think that I would have some conclusions for you. Not so, I'm afraid. That left me with a quandary: without conclusions, how could I draft a piece of prose for this space?

I couldn't. But while looking through my Reporter's Notebook at

all the notes I had scribbled as I traveled those miles and miles of booths, I realized that there was another way out. I may not have the answers, but boy, do I know the right questions.

The bad news is that, outside of the cabbie who drove me to the airport in Minneapolis—or my seat partner, who slept the entire way home—I had no one to interview but myself. "Would you, Mr. Fastie, agree to an interview for an upcoming issue of *PC Tech Journal*?" I asked myself.

Why not? First question, please.

*PCTJ: What has been the history of graphics on the IBM PC?*

*Fastie:* One of limited processor power and insufficient graphics resolution, I'm afraid.

*PCTJ: I see. Let me rephrase the question. In your original review of the IBM PC, published in Creative Computing, you praised the graphics capabilities of the PC and compared them favorably with the other machines then available. Why is your attitude different now?*

*Fastie:* We've just passed the third birthday of the IBM PC. A lot has happened since the machine first came out, most particularly with regard to the cost of memory chips. Because resolution and color are both dependent upon the amount of memory that can be dedicated to a video controller, better capability usually means more memory. Three years ago, that was a problem. Today, it is not.

Furthermore the capabilities of the PC upon its birth were better in some ways but worse in others than prevailing standards for small computers. For example, the resolution was better but the flexibility in the use of color was not as good.

The problem is that IBM has not improved the situation with the PC line. PCjr shows some improvement, but other compromises in its design reduce the power of PCjr as a graphics engine.

*PCTJ: So does that mean that the IBM PC is unsuitable as a graphics engine?*

*Fastie:* Not quite, and that's the main answer I learned at SIGGRAPH. What I discovered was a rash of PCs being used in many graphics systems for a variety of purposes. That indicates to me that the IBM PC has gained tremendous acceptance in the graphics community, not so much as a machine that can handle graphics, but as a standard frame upon which to build graphics systems. For example, most of the PCs I saw at SIGGRAPH sported a high-power graphics board, obviously not IBM's, and a third-party, high-resolution display.

Equally important, IBM PCs were the *only* small computers I saw being used in this fashion, with one exception (not including vendors' booths—such as DEC's, which was showing only DEC's own computers). The exception was one Apple Lisa. I was surprised to note that the Lisa, with its sophisticated



graphics capabilities, was not being used as a graphics engine.

**PCTJ:** *I don't understand. Why should suppliers of graphics systems be willing to settle for an IBM PC if it is underpowered?*

**Fastie:** I think they recognize that IBM is the most desirable computer from the buyer's point of view. So they jump on IBM's coat-tails and solve the power problem in their own way. By the way, these vendors had crowded booths at SIGGRAPH. Clearly, the IBM PCs sitting in their booths were a draw.

**PCTJ:** *Did you spot any trends at SIGGRAPH '84? What seemed to be the hot items?*

**Fastie:** I'm not sure that I detected any trends other than the use of PCs as a basic computer frame. As for hot items, there were three, one of which was, again, all the PCs I saw. The other . . .

**PCTJ:** *Excuse me. The trade press, including your sister publication PC Week, has reported the presence of PCs. Those reports indicated a few PCs, not many, as you seem to imply. How many did you actually see?*

**Fastie:** I'd say that about 20 or 30 booths had a PC. Considering what was reported to me about the previous SIGGRAPH, and adding to that what I have seen at other trade shows, I'd call that so-called "small" number explosive.

As for the other hot items, one is unrelated to the PC market, at least for the moment. Much emphasis was being placed on the integration of video with computer-generated graphics and animation. I think we are in for some continuing innovations in that area and, of course, the eventual use of PCs in that field, as well.

The other hotbed was graphics hard-copy devices. Prices are falling, and sophistication and quality are rising. There was even a color laser printer, something I had heard about but never seen before. These products will tend to increase the

downward migration of graphics applications to small computers.

**PCTJ:** *You said a moment ago that IBM had not improved the PC's graphics since it was announced. Is IBM standing still?*

**Fastie:** Quite the contrary. IBM is moving into this area very quickly. However, the first item on its graphics agenda relates, as it always has in other areas, to the company's large system business.

IBM has been aggressive of late with announcements of graphics workstations, some even based on the PC. The most visible, to coin a phrase, is the 3270-PC/G. This is a machine designed to be attached to a larger IBM system. Sure, it's a PC, but it is surely not meant to be used in the same way as a stand-alone, desktop PC would be.

I should also point out that IBM has always offered sophisticated graphics terminals to its mainframe customers, so the technology of graphics is certainly not unknown to the company.

**PCTJ:** *What do you think will happen to the PC?*

**Fastie:** I wish I knew. I was hopeful that a new adapter and display would be announced by IBM for the PC, but the rumors I've been hearing seem to contradict that. Most of these rumors center around the nature of the display subsystem for the new model PC, the one supposedly based on the Intel 80286 chip. That is supposed to have a higher resolution and good color.

**PCTJ:** *What should IBM do with the new PC or, for that matter, with the current machine?*

**Fastie:** I think it would be in IBM's best interest to develop a better, higher resolution standard for the PC, one that can be carried successfully into the new model as well. I think the minimum adequate specifications are 350 dots vertically by 720 horizontally. The full resolution mode should include at least four colors, all selectable from a palette of 16 colors.

The "medium-resolution" mode, call it *half-resolution*, would be nice at 350v by 360h and should offer all 16 colors. Medium resolution would be useful this way because it would be square from a coordinate point of view, even though it probably still would not have an aspect ratio of 1 on the display.

Actually, I would like to see more than four colors in the high-resolution mode. Three bits per pixel (giving eight colors) is a little hard to conceive, but four (16 colors) is not. Such a scheme would require 128K of memory, not a lot by today's standards and costs.

By the way, 350 by 720 is the same resolution currently generated on the IBM monochrome display, so good quality text should be possible to achieve on such a system, eliminating the need for two adapters and two displays and thus providing a more cost-effective solution than does the current PC.

**PCTJ:** *IBM doesn't offer many graphics programs. Can it really be competitive in this market?*

**Fastie:** If IBM builds the right hardware for the PC, the after-market will provide all the software, peripherals, and support that the end-user will need. A lot of that is now in place for the PC, even given its current limitations.

**PCTJ:** *So you're still positive about the PC in general and about its utility in the graphics market?*

**Fastie:** Yup. Although the machine is viewed by many as a conservative purchasing decision and not the best technology, it is more evident than ever that the IBM PC is the desktop computer of choice.





# Mr. Chips<sup>TM</sup> Plays Your PC Like a One Man Band

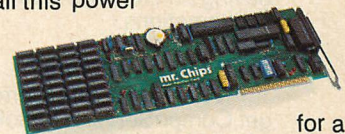


Mr. Chips, the new multi-function card from Orange Micro, adds a full ensemble of features to your IBM® PC. Memory, printer ports, and a clock are standard, and you'd expect them on a top quality board. But computing is changing.

Soon computers will take care of everyday things; like watering the lawn, or turning on your lights when it gets dark. And only Mr. Chips can do this now. These capabilities are standard, so your growing needs won't require additional equipment. There's also a dual game port, so you can duel to the end, by yourself or with a friend.

Every Mr. Chips comes with Chipdisk™ software, for RAM disk and print spooling. With RAM disk you set up your PC's memory to act like a disk drive. This means much faster execution and searching of programs. Print spooling sets your PC's RAM to serve as a printer buffer, so you can compute even while your printer is printing.

You can orchestrate all this power



for a remarkably low price. Visit your dealer and see for yourself: Mr. Chips is the multi-function card for today...and tomorrow.

## The First Multi-function Card with 9 Standard Features

- **Parallel Port\*:** Great for getting fast printouts on efficient dot matrix printers.
- **Serial Port:** The most popular way to access high grade letter quality printers or phone modem communications.
- **64K-256K RAM:** Upgrade your PC's memory to handle powerful integrated software and other larger programs.
- **Clock/Calendar:** Accurately keep track of time and date, even when your computer is turned off.
- **Dual Game Port\*:** Accommodate two complete joysticks at once, so you can play alone or duel with a friend. Also for use with CAD/CAM software.
- **Real World Interface:** This innovative port can monitor and control equipment like thermostats, moisture detectors, photocells and other independent devices.

- **BSR™AC Line Controller\*:** Control your lights, appliances, security systems, or anything that plugs into an AC wall socket.
- **Chipdisk RAM Disk:** Set your PC memory to act like a disk drive. Your programs will run much faster than with conventional disk drives.
- **Chipdisk Print Spooler:** Your PC memory will serve as a printer buffer, so you won't have to wait for your printer anymore.

\*Cables available separately



**Orange Micro**  
Inc.

1400 N. LAKEVIEW AVE., ANAHEIM, CA 92807 USA  
(714) 779-2772 TELEX: 183511CSMA

© Orange Micro, Inc., 1984

CIRCLE NO. 168 ON READER SERVICE CARD

■ BSR is a registered trademark of the BSR Corporation  
■ IBM is a registered trademark of International Business Machines Corporation



**What do you get when you cross  
1200 baud, free on-line time,  
and extra features at a price Hayes  
can't match?**

Shopping for a modem doesn't have to be a riddle. A tedious sifting through claims and counterclaims. A quest for the best that raises more questions than it answers.

The new MultiModem, from Multi-Tech Systems, gives you the right answers from the start. The answers to all your questions about what a first-rate intelligent modem should do for you.

#### **Data Transmission Speed?**

The MultiModem gives you a choice—either 1200 or 300 bits per second. 1200 for fast, efficient communications and lower long-distance charges. Like when you're downloading data from the corporate computer, or swapping files with a friend across the country. 300 bps for your less demanding applications, like checking out bulletin boards, playing games, or having on-line keyboard conversations.

#### **Free On-Line Time?**

With the MultiModem you get CompuServe's DemoPak—a free two-hour demonstration of their service, and up to seven more free hours of on-line time if you subscribe. You also get a \$50 usage credit from NewsNet, a service which lets you tap into 150 different specialized business newsletters.

#### **Intelligence? Extra Features?**

Of course, the MultiModem automatically dials, answers, and disconnects. But it does a few extra things too, things the Hayes Smartmodem 1200™ doesn't. Like recognize dial tones and busy signals, so the MultiModem will automatically redial, or automatically try a different number. And it remembers phone numbers too, up to six of them, in its battery-backed memory.

Trademarks—MultiModem, MultiCom PC, Multi-Tech Systems, Inc.—CompuServe, CompuServe Information Services, an H & R Block company—NewsNet, NewsNet, Inc.—Smartmodem, Hayes Microcomputer Products, Inc.—Crosstalk, Microstuf, Inc.—Data Capture, Southeastern Software—PC-Talk III, Freeware/The Headlands Press.

#### **Hayes-compatibility?**

Yes, the MultiModem is Hayes-compatible. (Most software requires modems that are.) That means the MultiModem will run with popular communications programs like Crosstalk XVI, Data Capture, PC-Talk III, our own MultiCom PC, and dozens of others.

#### **What About Price?**

At \$549, the MultiModem retails for \$150 less than the Smartmodem™. You get Hayes-compatibility and so much more—for so much less.

What do you get when you cross all these things? The MultiModem. From Multi-Tech Systems—a company that's been making top-quality modems for over thirteen years.

Isn't this the answer you've been looking for?

CIRCLE NO. 204 ON READER SERVICE CARD

For the name of your local distributor, write to **Multi-Tech Systems, Inc.** 82 Second Avenue S.E. New Brighton, Minnesota 55112. Or call us at (612) 631-3550.

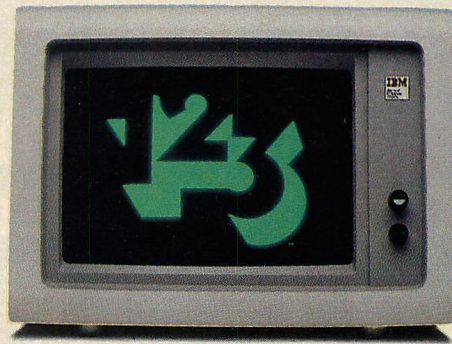
# MultiModem.



**MultiTech** Systems   
*The right answer every time.*



# HERCULES™ is the only graphics card that can run 1-2-3™ on IBM's monochrome display.



## And that's just for starters.

You don't have a Hercules Graphics Card? Then unfortunately you won't be able to run 1-2-3, including all its graphics, on IBM's monochrome display. And you'll miss out on all the other reasons why there are more Hercules Graphics Cards producing more high resolution graphics than any other add-on card for the IBM PC.

But don't take just our word for it. If you need convincing, remember that most of the IBM PCs at Lotus™ are running Hercules Graphics Cards. And the authors of 1-2-3 know a good card when they see one. Or consider that the Hercules Graphics Card is widely used at Rockwell, Mass Mutual, and Carnegie Mellon. They couldn't all be wrong, could they?

At \$499, we think the Hercules Graphics Card offers the best price/performance ratio of any graphics card available today. As you can tell, plenty of users agree with us.

Call or write for our free information kit. You'll see why the first graphics card for the IBM PC is still the best. Hercules Computer Technology, 2550 Ninth St., Suite 210,

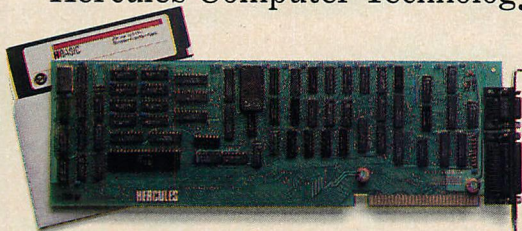
Berkeley, California 94710.

Telephone: (415) 540-6000.

## Hercules. We're strong on graphics.

©1983 Hercules Computer Technology.

CIRCLE NO. 151 ON READER SERVICE CARD



The Hercules Graphics Card offers 720 × 348 graphics resolution on IBM's monochrome display, compatibility with text mode software, a parallel printer port, software to use BASIC's graphics and a two year warranty. A graphics subroutine library with screen dump is available separately for \$50. Graphics software that is compatible with the IBM color graphics card but does not have a Hercules compatible version will not run on the Hercules Graphics Card. **Foreign Distributors:** Reflex/U.K.; Computer 2000/W Germany; Edisoft/France. Hercules Graphics Card is a trademark of Hercules Computer Technology. IBM is a registered trademark of International Business Machines. 1-2-3 and Lotus are trademarks of Lotus Development.



Before IRMA<sup>TM</sup>  
PC-to-mainframe  
communications  
had advanced just  
about this far.







Until just two years ago, communications between big IBM® mainframes and individual PCs was all smoke, without a bit of substance.

But two years ago, the smoke lifted.

With IRMA™, for the first time, PC users could extract needed information from the mainframe without going through MIS unnecessarily. All at once middle and upper management had a way to get timely information to make better decisions. But as revolutionary as IRMA was, it was far from the total answer.

The truth is, neither were our next two products. But we were getting closer. IRMAline™ and IRMAlette™ gave remote PCs the opportunity to communicate with the mainframes with the same ease as a local PC equipped with IRMA.

Because they were IRMA family products, all the software written for IRMA was

compatible with IRMAline and IRMAlette.

As we developed each new product to meet a business need, we saw more opportunities in the marketplace. And we responded to them.

With IRMAcom™, an IBM 3274, 3276 controller emulator. With IRMAprint™, an IBM 3287 emulator. With IRMAlink DBX/CICS™ an MIS-controlled data file transfer system. And with IRMAkey™, a keyboard that has every one of the functions of both an IBM terminal and PC.

For additional information about IRMA or any of the IRMA family of IBM-emulation products, send in the coupon below. Or call 1-800-241-IRMA. Telex 261375 DCAATL.

Mail to DCA, 303 Technology Park, Norcross, GA 30092.  
And we'll tell you more about all IRMA products.

Name \_\_\_\_\_

Firm \_\_\_\_\_ Title \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

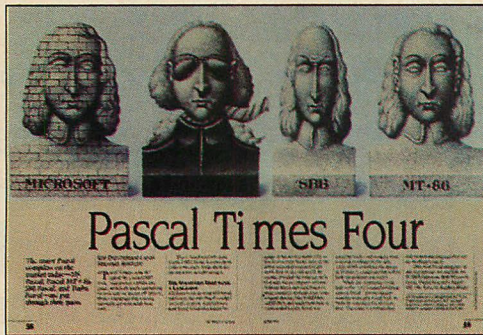
Phone \_\_\_\_\_



MP-02-07

IRMA, IRMAline, IRMAlette, IRMAcom, IRMAlink DBX/CICS, IRMAprint and IRMAkey/3270 are trademarks of Digital Communications Associates, Inc. DCA is a registered trademark of Digital Communications Associates, Inc. IBM is a registered trademark of International Business Machines Corporation. © 1984, Digital Communications Associates, Inc.





## PASCAL OPINIONS

After reading your recent review of Pascal systems ("Pascal Times Four," Jeff Duntemann and Michael Bentley, July 1984, page 58), I felt an urge to express an opinion regarding Borland's Turbo. I have been using it for a few weeks and am quite pleased—not only with the performance, but also with the cost.

George Grover  
Electronics for Industry  
Miami, FL 33186

The poor quality of documentation and support for most microcomputer software continues to amaze me. How will the industry ever reach its potential if naive users can't be brought on-stream without wasting time on wild goose chases? Is it any wonder that [Lotus] 1-2-3 succeeds among the professional who can least afford to waste time?

I'm a new owner of Microsoft Pascal 3.2. It was claimed to be fully compatible with both the R:Base Program Interface and the 8087 on my XT. Microsoft's documentation makes compatibility with the 8087 on the XT seem less than perfect, though readily achievable with a minor patch (page 10 and Appendix C of the User's Guide). The manual plainly states that a patch is required if "your hardware configuration meets any of the following criteria: (1) It uses an 8087 interrupt vector number other than 2. (2) It uses an 8259 interrupt controller. (3) The 8087 shares interrupts with another device on the same vector." (Microsoft's FORTRAN compiler documentation contains the same wording.)

On all IBM PCs and XTs an 8087 would use interrupt vector number 0, the nonmaskable interrupt, not 2. Similarly, they all have an 8259. On mine, if it used 2, it would conflict with my Microsoft Mouse, which in turn cannot use 5 where it would conflict with the hard disk.

Since until yesterday I hadn't had to know much about interrupts, I wanted to confirm my understanding with someone. The Programmer's Shop was helpful in attitude, but not in detail. They wished me luck in dealing with Microsoft. Three calls to Microsoft and 75 minutes on hold brought me the claim that I didn't have a problem because the documentation was in error.

Can you clarify whether Microsoft's documentation or its support staff is right about the need to patch its Pascal 3.2 to use the 8087 properly on an IBM PC or XT? *PC Tech Journal* and your article on Pascal compilers have been sources of good information for me in the past. Thanks for your help.

Dennis C. During  
Brooklyn, NY

*Microsoft's documentation is in error on this point. MS Pascal 3.2 needs no patching to operate correctly with the 8087 coprocessor. Benchmarks were compiled with MS Pascal exactly as it was received from Microsoft without patches.*

—Jeff Duntemann

Thank you for your insights into the various Pascals, even if they did nothing more than confirm my choice of MT+ for large overlaid programs.

I question your result of "failed" for the pentathlon floating-point test with the 8087. I tried on my machine (a Compaq Plus with 8087), and it seemed to work. I say seemed because the only criterion used in your benchmark is that the procedure bench1 ran to completion, not that it produced a certain numerical result. Is this a mistake?

It's a good thing that you did not review version 3.1 of MT+ or you would have had the result "failed" for all of the 8087 test, the 8087 library just flat out did not work.

Also, you did not mention the compatibility of MT+ with the other DRI

compilers both for the 8086 under PC-DOS and CP/M 86 and CP/M 80. Although this might not seem important for readers of an exclusively PC magazine, I think it is worth noting for those who want to write software that runs on a variety of operating systems.

Hardy Tichenor  
San Rafael, CA

*That particular benchmark (floating-point test) failed in that it locked up the machine and forced us to reboot. We ran the code again, and it failed in the same fashion.*

*Why your compilation worked while ours did not could be due to a number of different reasons, but I suspect the version of MT+86 that we tested was not identical to the version 3.2 release that was put into general distribution. Our copy came directly from DRI a little ahead of the official V 3.2 release date. Perhaps a leftover glitch from V 3.1 remained in that version.*

*On your point of compatibility, as we have little or no experience with other DRI compilers, such as CB 80, CB 86 and DR C, we did not feel we should comment. We do know, however, that MT+86 is extremely compatible with MT+80 and forms a good downward path from the IBM PC world to the eight-bit world of CP/M 80.*

—Jeff Duntemann

## THE REST OF THE STORY?

The report on the four COBOL compilers ("The Twelve Functional Modules of ANS COBOL: How Four Compilers Comply," Casey Pontius, April 1984, page 76) was an excellent article. However, following page 82 I could not find any closing comments or summary ended with the little PC system unit symbol anywhere in that issue. I infer thereby, that the article as printed was incomplete, and I have been looking for a follow-up in subsequent issues, with



# KnowledgeMan<sup>TM</sup> beats dBASE<sup>®</sup> over 250 ways.

You get more from KnowledgeMan. Relational data management, ad hoc queries (like IBM's SQL/DS), spreadsheet, math and statistics, printed forms management, screen I/O management, a full-scale programming language. **Plus** you can now get a text processor, a forms painter, color graphics and a run-time version.

If you'd like to see more about how KnowledgeMan beats dBASE, see your dealer today and ask for a free feature-by-feature comparison. Or call or write: Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902, (317) 463-2581.

CIRCLE NO. 118 ON READER SERVICE CARD

**DATA MANAGEMENT**

- Tables open concurrently
- Fields per record (max)
- Supports virtual fields
- Records per table (max)
- Characters per table (max)
- Index keys per record (max)
- Characters per index key (max)
- Encryption, passwords
- read/write protection
- Fields defined with edit pictures
- Create/Modify records directly from spreadsheet
- Table sorting on multiple fields

**FILE INQUIRY**

- Can open multiple tables with a

**AD HOC INQUIRY**  
 Query multiple tables with a single command  
 Query syntax like IBM's relational SQL/DS  
 Supports full wildcard matching  
 Supports the IN operator  
 Supports UNIQUE table output items  
 Dynamic sorting of query output  
 Multi-field control break groupings

**SPREADSHEET**  
Spreadsheet size  
Cells defined in terms of:  
Traditional formulas  
Data management operations  
Entire programs  
Spreadsheet can be built/invoked  
within any program  
Interactive spreadsheet evaluation  
with multi-color forms

dbase II	Knowledge
2	unlimited
32	255
no	yes
65535	65535
1000	65535
unlimited	unlimited
100	65535
	yes
no	yes
no	yes
no	
no	

no  
yes

no yes  
no yes  
no yes  
no yes  
no yes  
no yes  
no yes

$0 \times 0$

no  
no  
no  
  
no  
  
no

**FORMS MANAGEMENT**  
Form-at-a-time processing commands  
for screen I/O and printer output  
Multiple color blocks per form  
Special effects for each form element:  
Blinking, reverse video,  
low intensity, bell, colors  
Form-oriented record creation  
and browsing

**PROGRAMMING LANGUAGE**

- Numeric functions:
  - Absolute value, exponentiation, logs, trigonometric functions,
- random number generator, etc.
- Working variables:
  - Maximum number
  - Maximum length
- Arrays (1-dimensional)
- Arrays (2-dimensional)
- If-Then-Else, While-Do,
- Test-Case
- Maximum levels of procedure nesting
- Maximum parameters per procedure
- Program encryption

Entries are based on documentation and other vendor information and are believed to be accurate but are not guaranteed.  
©1984, Micro Data Base Systems, Inc.

John -  
"K-man" not only  
looks superior  
to dBASE, I've  
checked it against  
others & it seems  
to be a generation  
or two ahead!  
J.P.

	Last Period	User Entry	Computed
14			
15			
16			
17			
18			



## LETTERS

no success as yet. Am I looking for the proverbial "needle in a haystack," or is the summary still to come?

Jeff Davidson

*Sorry for the confusion. We discovered the loss of the "end slug" only after the issue went to press. Not to bore you with publishing details, but that end slug is something that has to be added manually (that is, it cannot be set by the typesetting computer), and somebody obviously goofed.*

*That was the end of the article. We specifically avoided conclusions in that piece because we were trying to report on ANSI compliance, not the nature of each particular product. We are working now on reviews of the major products.*

*Thanks for your note.*

—WF

### A PATCH TO MATCH 2.1

James Folts' piece on "Disarming DOS FORMAT" (July 1984, page 32) presents an excellent way to obviate a real danger. I know of two misFORMATs that wiped out hard disks at my firm. Giving computer power to nontechnical users has created a whole industry; it is, however, unfortunate that much of the resultant system is not ready for these users. The ability to erase megabytes of information inadvertently and easily while attempting an often-used and necessary utility is one example of this; another case is the near certainty that the sad user with the reformatted disk has not backed up recently. A back-up requiring much time spent shuffling diskettes is worse than no back-up—it lets the user rationalize putting off doing it, and it lets the system manufacturer rationalize putting off providing a real back-up facility.

Enough of this complaining. FORMAT.COM has been changed with DOS 2.1. The accompanying table shows Mr. Folts' patch as I have rewritten it for DOS 2.1.

These instructions should look remarkably similar to Mr. Folts'; I just found the analogous code in DOS 2.1 and changed the addresses.

Jonathan Van Houtte  
Albany, NY

*We have received several letters requesting a patch for FORMAT.COM version 2.1. Mr. Van Houtte's letter shows how. We changed his code to give an error message for any drive C or greater.*

—SG-C

### DOS 2.1 FORMAT Patch

Type DEBUG FORMAT.COM (enter).

Check your FORMAT utility to be sure it is the correct code for this patch.

#### -U 19E

```
xxxx:019E BA5C09 MOV DX,095C
xxxx:01A1 B425 MOV AH,25
xxxx:01A3 B023 MOV AL,23
xxxx:01A5 CD21 INT 21
```

Change the instruction at 19E so that we can add the patch:

#### -E 19E

```
xxxx:019E BA.E8 5C.1F
xxxx:01A0 09.18
```

Dump from location 19C0 to make sure it is zeros:

#### -D 19C0

```
xxxx:19C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
xxxx:19D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
xxxx:19E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
```

Now assemble the trap:

#### -A 19C0

```
xxxx:19C0 CMP AL,2;is fixed disk drive C?
xxxx:19C2 JNL 19C8 ;print error message
                ;if drive >=C.
xxxx:19C4 MOV DX,95C
xxxx:19C7 RET
xxxx:19C8 MOV DX,FAF
xxxx:19CB JMP 4FB
xxxx:19CE C
```

Dumping from 19C0 should show:

#### -D 19C0

```
xxxx:19C0 3C 02 74 04 BA 5C 09 C3 BAAF 0F E9 2D EB 00 00<}. \.C:/i-k ....
xxxx:19D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
xxxx:19E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
```

#### -W

#### -Q

### IMPROPER EXIT

While the article "After Bubblesort: Sorting Methods and Timing on the IBM PC" by Eliezer Naddor (April 1984, page 40) was excellent, there is a potentially serious (though common) error in some of the published sort routines.

The error involves an improper FOR loop exit and is present in the insertion sort and shell sort algorithms (figures 4C and 4D.) The insertion sort routine is the following:

```
3300 FOR I=2 TO N:T$=V$(I)
3305 FOR J=I-1 TO 1 STEP -1
3306 IF V$(J) <= T$ THEN 3315
3310 SWAP V$(J+1), V$(J)
3312 NEXT J:J=0
3315 SWAP V$(J+1), T$
3320 GOSUB 6900
3325 NEXT I:RETURN
```

Observe line 3305: the branch is out of the inner loop directly to the outer loop. This is not only poor practice,

but also it can result in damaged data and/or a program crash.

Each time Microsoft BASIC executes a FOR loop, it stores the beginning address of the loop by pushing it onto BASIC's stack. If the loop is exited improperly, only a small number of times, the stack is large enough so these pushed addresses will not cause a problem. However, if the SORT routine is used to sort a large amount of data, it is possible for the stack to overflow and cause all kinds of trouble. On older CP/M machines, the stack overflow would overwrite data and even the program itself; what gets overwritten on an IBM PC is an open question. Maybe nothing. Maybe Microsoft has bowed to the inevitable and taken care of the problem in the interpreter. Still, I haven't seen any notice of such a change.

The BASIC manual (somewhere) specifically warns against exiting FOR



loops in this way, the WHILE/WEND construction was added to the BASIC interpreter and compiler by Microsoft specifically because of this problem. Moreover, WHILE/WEND loops may be exited in the "improper" manner without any similar problems because the return address is not placed on a stack.

This particular way of coding loops is common, and your publication is neither the first nor, I fear, the last to print a program using it. Please warn the author and your readers against using such dangerous and illegal methods. If the BASIC manual specifically warns against doing something, it is usually with good reason.

Bruce W. Tonkin  
Round Lake, IL

*Mr. Tonkin's complaint is not supported by the BASIC manual. On the contrary, on page 4-89 the manual actually speaks of branching out of a loop.*

—Eliezer Naddor

## TWO B: OR NOT TWO B:

In "Nested Batch Files" (November/December 1983, page 223) Jeff Garbers described how a secondary command processor can be used to run nested batch files. I have just been trying unsuccessfully to apply this to a pair of batch files that are on different drives.

From Garber's article and, more particularly, from page 10-9 of the PC-DOS 2.0 manual, I am led to expect that the line

## COMMAND B:/C B:FILE2

appearing in A:FILE1.BAT should hand over control to FILE2.BAT on DRIVE B. Yet with this and with every plausible variation I have tried, I get the message, "Specified COMMAND search directory bad," before being rather abruptly ushered out to the DOS prompt.

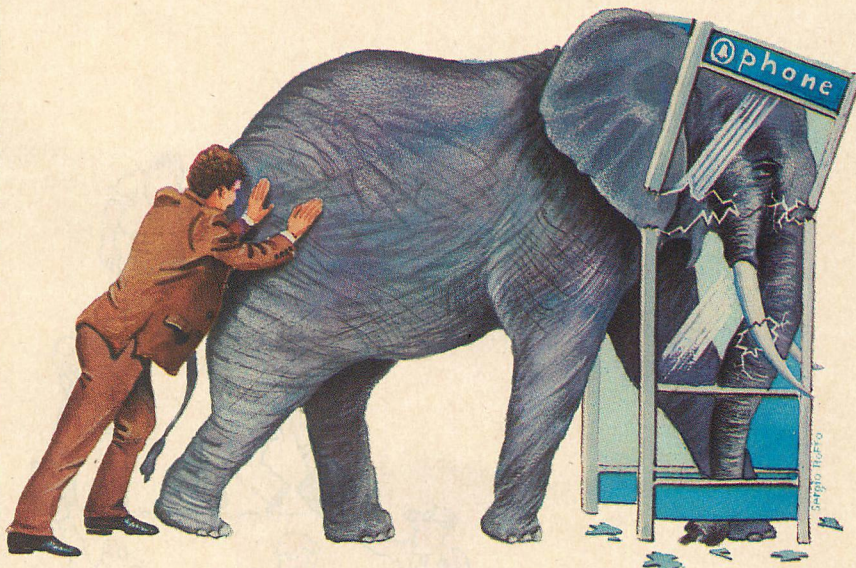
What's wrong here?

Sid Socolar  
New York, NY

*Mr. Socolar's problem is my favorite kind: it's both interesting and easy to solve. All he needs to do is leave out the first "B:", leaving his command line as "command /C B:FILE2". This seems to work quite well.*

*His approach fails for two reasons. According to the page he cites in the DOS manual, the parameter appearing before the /C in the COMMAND line specifies "the directory searched for the command processor to be loaded". So Mr. Socolar's command line would tell*

# Squeezing A Large Program Into A Small Memory Space?



It's time you got Plink86™ the overlay linkage editor that's bringing modular programming to Intel 8086-based micros.

With Plink86\*, you can write a program as large and complex as you want and not worry about whether it will fit within available memory constraints. You can divide your program into any number of tree-structured overlay areas. 4095 by 32 deep. Work on modules individually. Then link them into executable files. All without making changes to your source program modules.

Use the same module in different programs. Experiment with changes to the overlay structure of an existing program. Use one overlay to access code

and data in other overlays.

Plink86 is a two-pass linkage editor that links modules created by the Microsoft assembler or any of Microsoft's 8086 compilers. Plink86 also works with other popular languages, like Lattice C, C86, or mbp/COBOL. And supports symbolic debugging with Phoenix' Pfix86 Plus™

Plink86 includes its own object module library manager – Plib86™ – that lets you build libraries from scratch. Add or delete modules from existing libraries... Merge libraries... Or produce cross-reference listings.

Why squeeze any more than you have to? Plink86 by Phoenix. \$395. Call (800) 344-7200, or write.

*Phoenix*

**Phoenix Computer Products Corporation**

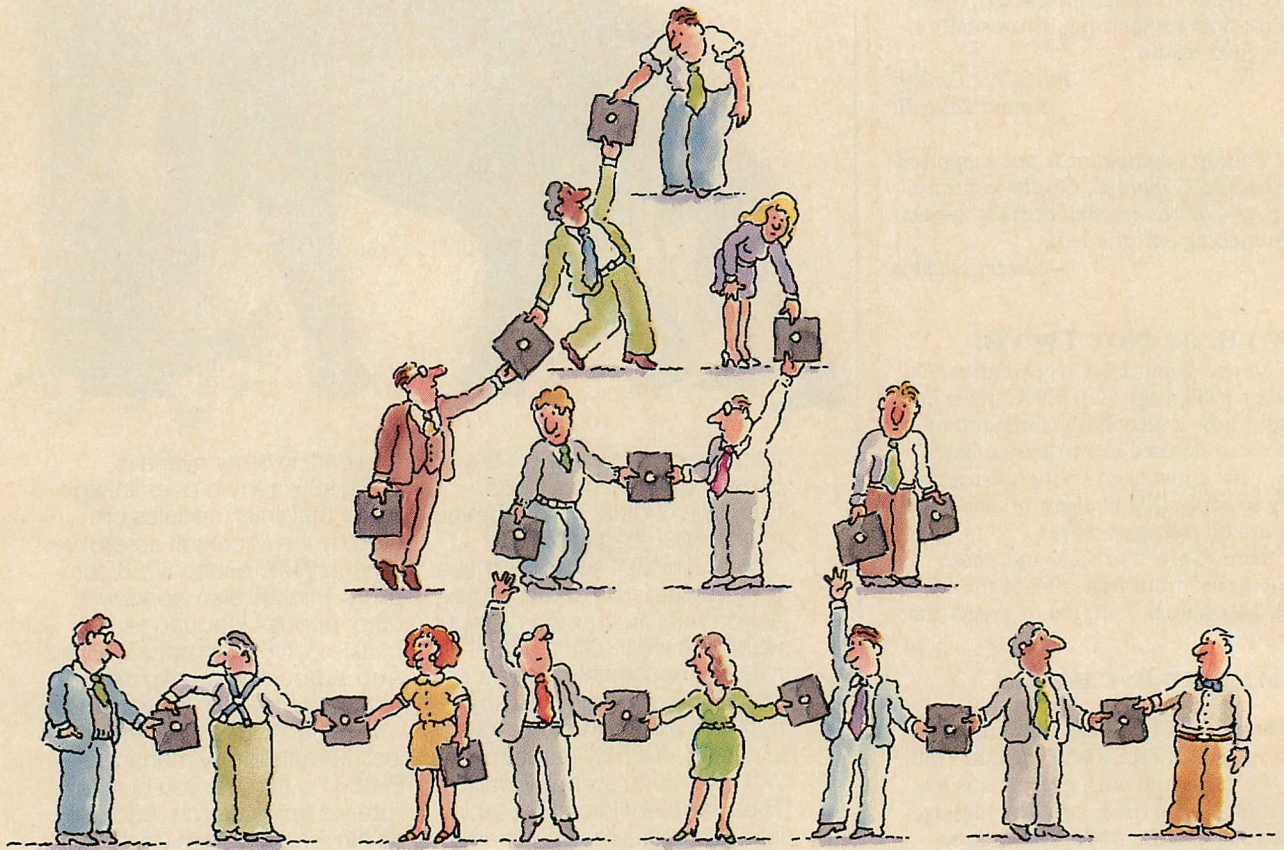
1416 Providence Highway, Suite 220  
Norwood, MA 02062  
In Massachusetts (617) 762-5030

\*Plink86 will run under PC DOS, MS-DOS™ or CP/M™-86.

Plink86, Pfix86 Plus and Plib86 are trademarks of Phoenix Software Associates Ltd. MS-DOS is a trademark of Microsoft Corporation. CP/M is a trademark of Digital Research, Inc.



# THE END OF SOFTWARE FREEBIES.



Finally there's a foolproof way to protect software against unauthorized duplication. And the technology is all on the disk itself.

The new Prolok™ disk doesn't need add-on hardware. Instead each diskette is marked with a unique, physical "fingerprint." No two are alike. A precise description of the individual print is encoded magnetically. The fingerprint AND the description must match exactly before the software is decrypted and released to the system. No match, no access.

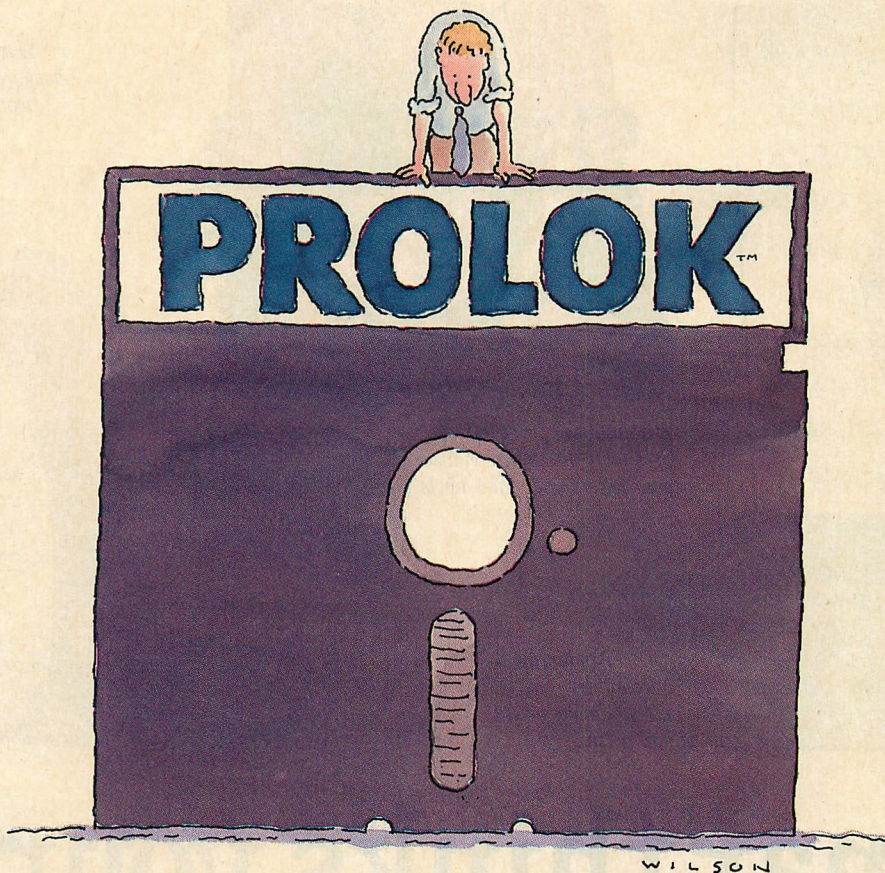
Its genius is its simplicity and familiarity. Prolok looks like an unprotected disk, loads like an unprotected disk, works like an unprotected disk. The user feels immediately at home and in command.

Backups are easily made via normal system utilities. However, to be read they must be accompanied in the system by the original Prolok disk.

Prolok puts the casual copier—and even the deliberate pirate—out of business. It barely

## PROLOK. SOFTWARE





increases the price of your product, yet it makes sure your customers don't buy one program and copy ten.

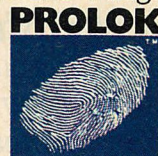
Several command line slash (/) options are built into Prolok diskettes for customized security, depending on your needs.

Software can be loaded easily onto Prolok diskettes using any system from a PC to commercial mass duplication equipment.

Prolok is an engineering breakthrough of Vault Corporation, which has been success-

fully safeguarding software since the inception of security disk technology. Over 2000 businesses and organizations protect their valuable programs with Prolok.

Simply contact Vault Corporation at 2649 Townsgate Road, Suite 500, Westlake Village, CA 91361. Or phone us at 800-445-0193 (U.S.) or 800-821-8638 (California). And find out why software freebies are becoming a thing of the past.

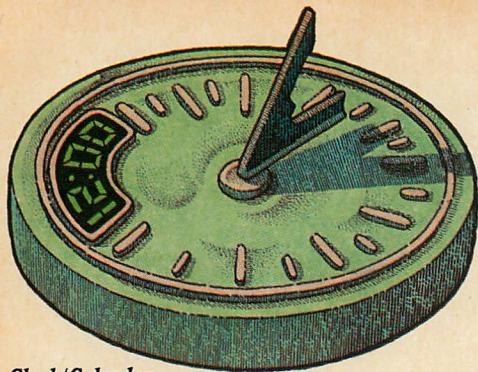


# PROTECTION, RIGHT ON THE DISK.

Copyright ©1984 Vault Corporation Prolok is a trademark of Vault Corporation

CIRCLE NO. 180 ON READER SERVICE CARD





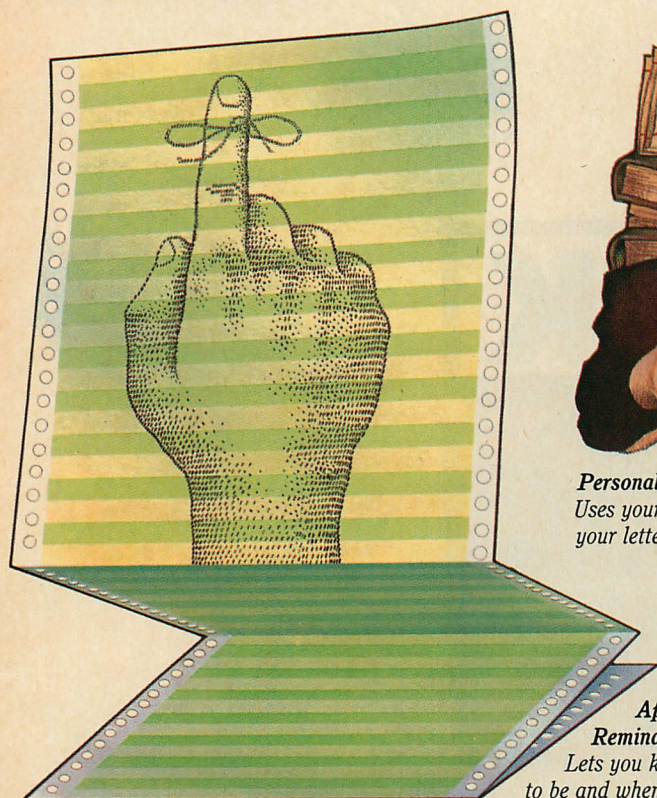
#### **Clock/Calendar**

*Automatically inserts the date and time when you turn on your computer.*



#### **Encode/Decode**

*Ensures the security of your files.*

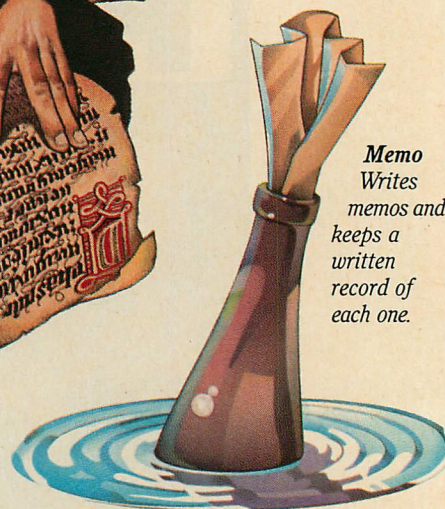


#### **Personalized form letters**

*Uses your file to personalize your letters and make labels.*

**Calculator**  
*Does your figuring in background mode so you won't have to change programs.*

**Memo**  
*Writes memos and keeps a written record of each one.*



#### **Appointment Reminder**

*Lets you know where to be and when.*

# Tecmar thinks your PC

As your business grows, so should your computer. Only Tecmar offers you this unique package of hardware and free software. With it your PC can grow to its full potential.

## **Tecmar Multifunction Boards...**

*"extremely powerful."—PC World*

A Tecmar board will expand your computer's memory and increase its speed and efficiency. It will give you additional ports to accommodate a wide range of peripherals from modems and plotters to dot matrix and letter quality printers.

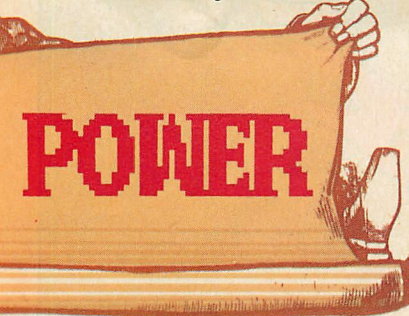
With a Tecmar board you can run powerful programs like Lotus 1-2-3™\* and WordStar®†† on a PCjr. The RamSpooler makes printing a background task and frees your PC for other jobs. A built-in clock/calendar automatically inserts the date and time at power on and is independently powered by an easily replaced battery.

Every Tecmar multifunction board is run through a series of rigorous tests to ensure quality. Our incredibly low failure rate (0.4%) is unparalleled. All boards are additionally backed by a full one-year warranty.



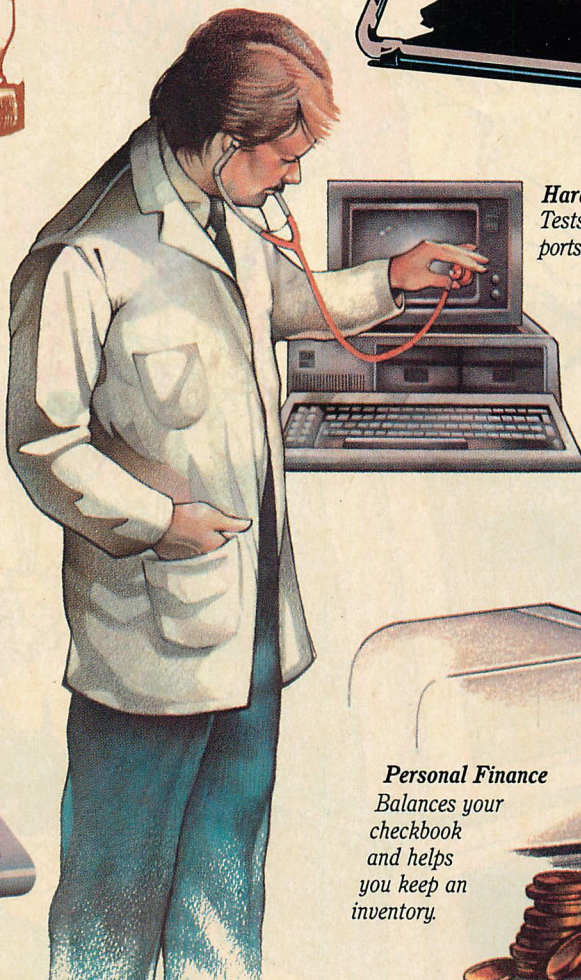
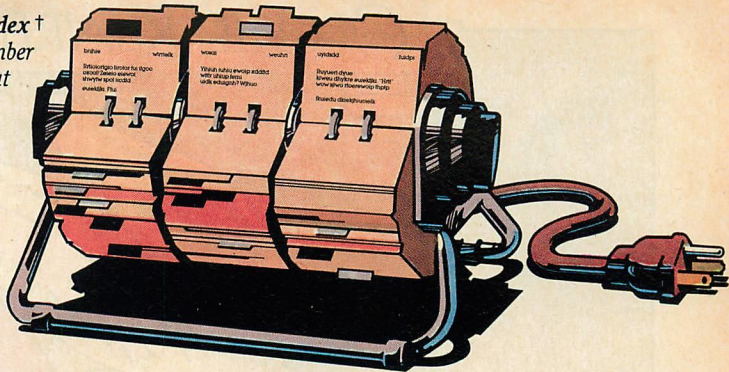
### Banner

Allows you to print in a variety of type sizes. Even large banners!



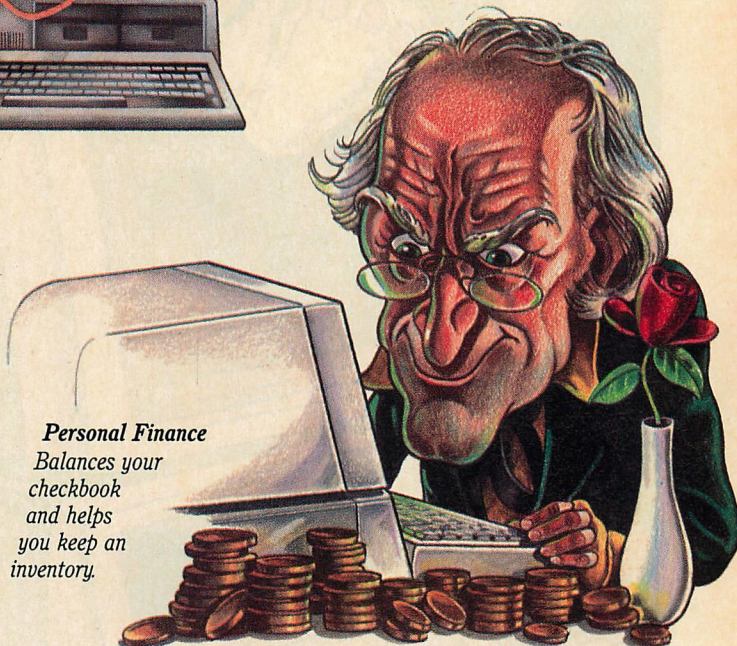
### Rolodex†

Finds the name and number you need instantly without changing programs.



### Hardware Diagnostics

Tests your PC's memory and parallel ports to stop problems before they happen.



### Personal Finance

Balances your checkbook and helps you keep an inventory.

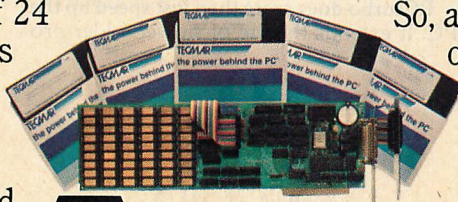
# should do all of the above.

## Free Software "...a chest of Jewels."—PC Week

Great hardware deserves great software. So, if you buy a Tecmar board we'll give you our Treasure Chest™ of Software at no extra charge. The Treasure Chest consists of 24 programs that include business applications, a calculator, a security system, hardware diagnostics, even games! Most of these can be run in background mode with programs like Lotus 1-2-3 and WordStar. Using these

features is as easy as a couple of keystrokes, and without changing disks. No other company offers you such an extensive array of software with their multifunction boards.

So, ask your dealer for a demonstration of any of Tecmar's multifunction boards. And check out the free software while you're there. Or call 216-349-0600 for the dealer nearest you.



# Tecmar

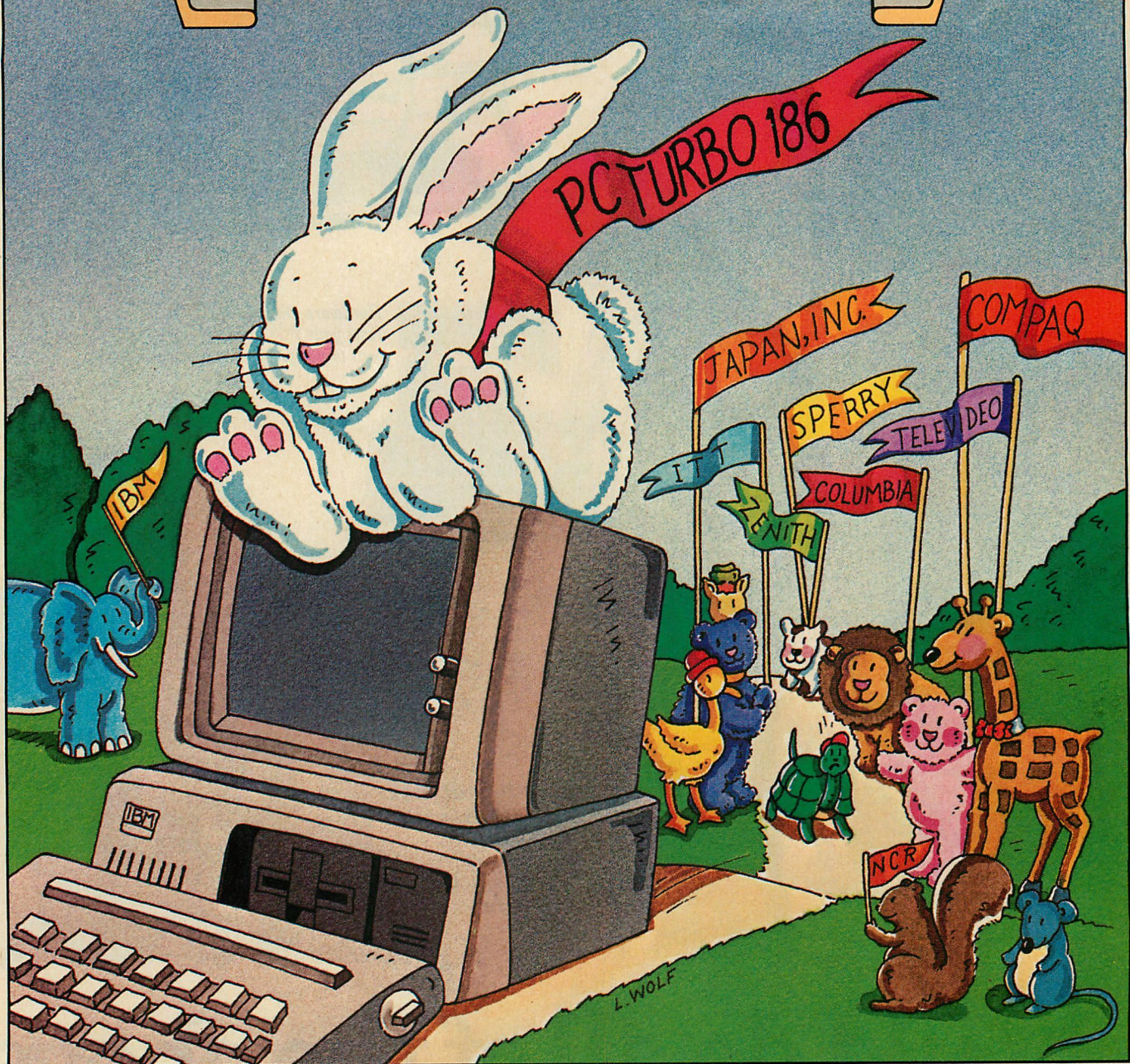
THE POWER BEHIND THE PC

CIRCLE NO. 195 ON READER SERVICE CARD

© Lotus 1-2-3 is a registered trademark of the Lotus Development Corporation.  
†Rolodex is a registered trademark of the Rolodex Corporation. ††WordStar is a registered trademark of the MicroPro International Corporation.



# ORCHID REWRITES AESOP'S FABLES



## PC TURBO 186...Speed Wins the Race.

In business, success comes to those who win the race against deadlines and competition. The IBM™ PC is a great tool, but valuable time can be wasted waiting for it to recalculate spreadsheets, retrieve data, or execute the newer and more complex software packages. PCturbo™, new from Orchid, can help you win and enjoy the fruits of success.

PCturbo is the ultimate IBM PC productivity enhancement. It boosts the execution speed of your PC so you can get more done in less time. And it's transparent to existing programs such as WordStar™, Lotus 1-2-3™, and dBase II.™ So, with PCturbo, your PC looks and acts the same as before; it just runs faster.

**Who needs PCturbo?** Anyone who ever waits for their PC to finish executing so they can run something else. Programmers wait-

ing for compilers to finish before testing a new feature. Businessmen waiting for a data base to retrieve account information. Word processors waiting for the spelling checker to finish before printing.

**PCturbo does more than just speed up the PC.** It extends the life of slower, older pro-

grams. It provides a base for new sophisticated software. And it protects your PC investment. You get your work done quicker and decisions made sooner. The very reasons you got a computer in the first place. Write or call for more information.



ORCHID TECHNOLOGY

47790 Westinghouse Drive

Fremont, CA 94539

(415) 490-8586 Telex: 709289

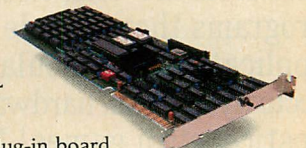
### TECHNICAL DETAILS:

#### Hardware

- One slot plug-in board with high-speed processor (80186)
- Up to 640K on-board memory for a maximum of 1.28 Mbytes total PC memory.

#### Software

- Runs IBM PC-DOS.
- Provides disk caching, RAM disk using available PC memory up to 640 Kbytes.



CIRCLE NO 227 ON READER SERVICE CARD

PCturbo is a trademark of Orchid Technology. IBM PC and XT are trademarks of International Business Machines Corporation. WordStar is a trademark of MicroPro. Lotus 1-2-3 is a trademark of Lotus Development Corporation. dBase II is a trademark of Ashton-Tate.



## LETTERS

DOS to look on Drive B: for the command PROCESSOR, not the command to be processed. If he leaves that optional argument blank as I suggest, DOS will look for the command processor in the path specified by the environment's COMSPEC variable.

The second problem is more subtle. Without a space between the first B: and the /C, COMMAND's parser doesn't interpret the /C as a switch. Instead, it apparently takes "B:/C" as an indivisible string, and tries to interpret it as the directory to be searched for the command processor. This could have something to do with the fact that under certain undocumented conditions, DOS will accept the forward slash as well as the backward slash as a path name delimiter.

—Jeff Garbers

## PNP UPDATE

There is a conflict between Peeks 'n Pokes (PnP) and the Hercules Graphics Card. The Hercules card uses the same control port (952 or 3B8H) as the IBM monochrome card, but it uses a previously unused bit (bit 1) to indicate graphics mode. CRT.BAS and CRTDEMO.BAS in PnP set this bit when disabling the screen and blink. This can damage the monochrome monitor if the Hercules card is used.

To eliminate the conflict, we have a new version of PnP, numbered 2.1. To update your disk, replace the lines in the two programs as shown below. Note that this fix does not work for the Hercules graphics mode.

CRT.BAS (change three lines)

260 OUT 952,41 ' Turn monochrome display back on

300 OUT 952,9 ' disable monochrome blink

320 OUT 952,41 ' enable monochrome blink

CRTDEMO.BAS (change four lines)

50 IF (PEEK (16) and 48)=48 THEN  
DEF SEG=45056!:

OUTBUFF=952:GOTO 70 ' monochrome

60 DEF SEG=47104!:OUTBUFF=  
984:SCREEN 0 ' color

180 OUT OUTBUFF,9

210 OUT OUTBUFF,41

After making the above changes, change line 40 in the program MENU.BAS to display version number 2.1

Brett Salter  
Data Base Decisions  
Atlanta, GA

NEW From The Makers Of **Newsapper™** and **Newsap™**

# Keyswap 3.0

From the designer software series!



The Unique Keyboard Utility with:

- **ONLINE MACRO LISTING**  
(See a listing of your macros at any time - instantly!)
- **ONLINE FULL SCREEN MACRO EDITOR**  
Create or Modify your macros from within your favorite software programs.
- **USER DESIGNABLE HELP MENU CREATION**  
Quickly and easily create your own help menus that can be displayed within your programs.

**KEYSWAP 3.0** is the most advanced macro processor available for the IBM PC, XT and COMPATIBLES! - Includes ALL OF PROKEY'S FUNCTIONS and many more.

**KEYSWAP 3.0** is the macro processor that can add a new dimension in USERFRIENDLINESS to your PC.

### WITH KEYSWAP 3.0 YOU CAN:

Record a series of complicated keystrokes used to invoke and set up a program for data entry.

Condense many time consuming keystrokes into just one.

Create "lessons" that can be played back at variable speed for tutorial or demo purposes.

Create a single macro definition as large as 64K.

Redefine any keys (i.e. shift) or define any macro character.

**IMAGINE:** Automatic time and date display; fixed and variable definition fields; audible feedback on toggle keys; alternate cursor control selection, and keyboard customization.

**KEYSWAP 3.0 - State of the art keyboard utility software. For the IBM PC, XT, and IBM COMPATIBLES.**

PRICE: \$119.00 (RETAIL)

+ 2.50 Shipping & Handling. MA res add 5% Sls. TX.

SPECIAL OFFER:

TRADE IN YOUR OLD MACRO PROGRAMS:

KEYSWAP (PER), PROKEY\*, etc.

(Call or write for details)

**RICKERDATA**

P.O. Box 998, Melrose, MA 02176 (617) 662-0856

MC & VISA ACCEPTED

\*Registered Trademark RoseSoft

\*\* Registered Trademark IBM.



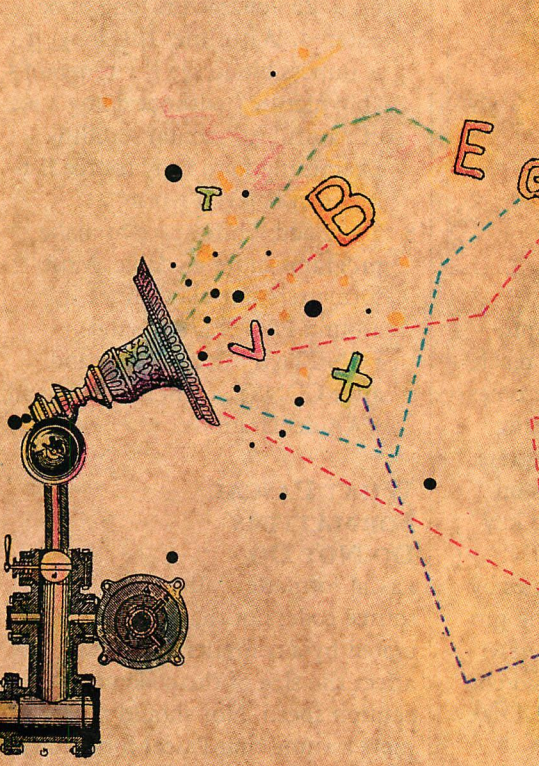




STEVEN ARMBRUST AND TED FORGERON

# THE WELL-FORMATTED PASCAL

PROGRAM SIEVE:  
( THE ERATOSTHENES' SIEVE BENCHMARK )



```
CONST SIZE = 8190;  
TYPE BYTE = 0..255;  
VAR I, PRIME, K, COUNT, ITER : IN GER;  
    FLAGS : ARRAY [ 0..SIZE ] OF BOOLEAN;  
  
IN  
  WRITELN( 'START' );  
  FOR ITEM := 1 TO 10 DO BEGIN  
    COUNT := 0;  
    FOR I := 0 TO SIZE DO FLAGS[ I ] := TRUE;  
    FOR I := 0 TO SIZE DO  
      IF FLAGS[ I ] THEN BEGIN  
        PRIME := I + I + 3;  
        K := I + PRIME;  
        WHILE K <= SIZE DO BEGIN:  
          FLAGS[ K ] := FALSE;  
          K := K + PRIME  
        END;  
        COUNT := COUNT + 1  
      END;  
    END;  
  WRITELN( COUNT, 'PRIMES' )  
END.
```

*Two Pascal formatting utilities: TIDY is tidier than PASCAL UTILITIES, but either of these packages is worth having.*

Everybody loves reading well-formatted Pascal code, but after five or six revisions of a program, most people don't really feel like fixing all the BEGIN . . . END blocks so they are indented properly. Also, because the Shift key on the IBM PC is hard to reach, it is annoying to have to type all the reserved words in upper-case letters. Most programmers really intend to go back later and make their programs prettier, but sooner or later their good intentions dwindle away.

---

Steven Armbrust has been a technical writer in the computer industry for more than a decade. Currently he is working as a senior documentation engineer at Multisoft Corporation in Beaverton, Oregon. Ted Forgeron is vice president of systems software engineering, also at Multisoft Corporation.



Luckily, there is a way to have well-formatted code without the frustrations of having to type it in that way. Now there are utilities, called in generic terms *Pascal formatters*, that can turn even the murkiest Pascal source code into easy-to-read, professional-looking code. This article discusses Pascal formatters—what they are and how they are useful. It also examines two products available for the IBM PC: TIDY from Major Software and PASCAL UTILITIES from Seven Valleys Software.

## WHY BOTHER?

Pascal compilers allow source statements to be "free form," which means that statements can be entered in just about any form, with no regard for indentation, capitalization, or blank lines. So why bother with formatting rules, especially since properly formatted code runs no faster than any other kind?

Programmers use formatting rules to make source code more readable, easier to debug, and easier to modify. Two formatting considerations are especially important: indenting and capitalization.

Pascal is a structured language, and indentation is often used to separate the individual blocks from one another in a hierarchical fashion. The indentation of a program listing should clearly show the flow of control through the program; if this flow is clear, it is easier to control logic errors, such as improperly nested IF statements.

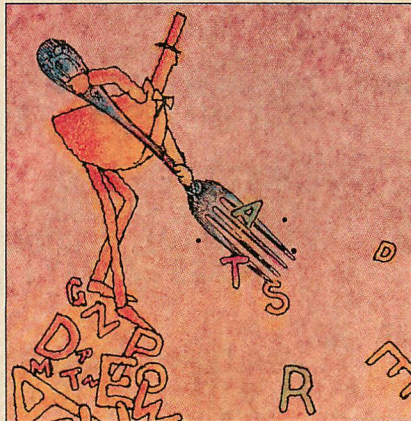
Indentation also helps to clear up complex data descriptions, such as a RECORD with many fields. Pascal records can be hierarchical, and using indentation can help keep the hierarchy straight.

Capitalization helps make the essence of the program easily visible. By capitalizing the Pascal reserved words (such as BEGIN, END, IF, THEN, ELSE, etc.), programmers can make the action words stand out against the rest of the program.

## WHAT PASCAL FORMATTERS DO

Pascal formatters take source code—regardless of the formatting rules used in creating it—and turn it into consistently formatted source code. The formatting rules used by these utilities vary from product to product, but most Pascal formatters perform the following operations:

1. They transform Pascal reserved words into upper-case letters. This makes the program more



readable, and it keeps the programmer from constantly reaching for the Shift key as he types.

2. They enforce rules of spacing and indenting. Most formatters begin all Pascal statements on new lines. They also place key words like REPEAT, BEGIN, END, and RECORD on lines by themselves. This allows the programmer to keep track of new operations easily and to find corresponding BEGIN and END key words at once.

Formatters indent the bodies of BEGIN . . . END, FOR, REPEAT, WHILE, WITH, and CASE statements from the key words. They also indent the bodies of LABEL, CONST, TYPE, and VAR declarations from the declaration key words. Structures and IF . . . THEN . . . ELSE clauses are treated similarly.

Formatters vary in the number of spaces they indent, but the best ones indent two spaces for

each level of indentation. Indenting more than two spaces causes "rightward creep" when complex programs are involved (most of the code ends up on the extreme right side of the page). Indenting less than two spaces per level makes it hard to distinguish the individual levels.

3. They format comments in special ways. Most formatters adjust comments so that they begin in the same column or use a consistent amount of spacing before and after the comment.
4. They enforce a maximum line length of 80 characters. Many text editors allow lines that are up to 255 characters long to be entered. With lines this long, it is impossible to see the program's "big picture" without doing a lot of painful horizontal scrolling. Examining hard-copy source listings can be even worse.
5. They add white space to make programs more readable. Most formatters put blank lines around PROCEDURE and FUNCTION declarations and after CONST, LABEL, TYPE, and VAR declarations.

## WHAT PASCAL FORMATTERS DO NOT DO

Pascal formatters affect only the source code, not the object code generated by a compiler. They will not affect the size of the code or its execution speed. Nor should programmers assume that Pascal formatters are syntax checkers—they are not. Code that will not compile before it is run through a formatter certainly will not compile afterward. In fact, using a formatter on code that contains syntax errors often increases the number of problems.

## WHO SHOULD USE A PASCAL FORMATTER?

Pascal formatters are useful for programmers working on individual projects and for programmers work-





# We've turned hard disk storage into an affordable reality.

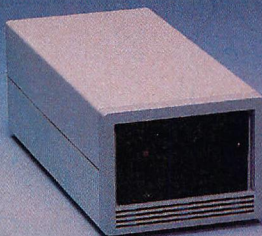
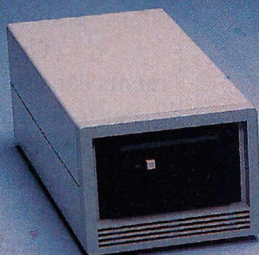


Half-height 3.3 super  
floppy disk system.

**Coming Soon**

Half-height  
5 Mbyte removable  
hard disk system.  
Allows easy primary  
or backup storage  
through inter-  
changeable disks.

**\$1895**



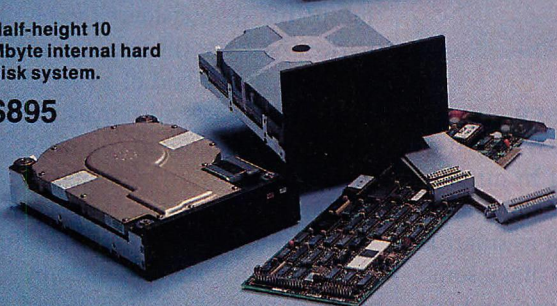
Half-height streamer  
tape system. Ideal data  
backup system for  
large-scale  
storage.

**\$1095**



Half-height 10  
Mbyte internal hard  
disk system.

**\$895**



Half-height external  
hard disk system (10,  
20, or 33 Mbyte). Also  
accommodates  
half-height backup  
system.

**\$1295-\$2295**



## Kamerman Labs combines the speed and storage capacity of hard disk technology with prices you can't afford to pass up.

### A dramatic leap in performance for your personal computer.

Even the smallest Kamerman Labs hard disk unit gives you 30 times the storage capacity of a typical floppy disk. Sophisticated business and professional data storage requirements can now be handled with ease.

Better yet, you can access data up to 10 times faster than with floppies. Spend more time working and less time waiting.

And it's easy to use. Kamerman Labs lets you boot directly off the hard

disk, just like the IBM XT.

### A complete backup solution.

Backup of hard disk data is a critical requirement in many microcomputer applications, so Kamerman Labs offers several reliable and cost-effective backup devices that are fully compatible with our hard disk units.

### Lower prices than ever.

Because you deal directly with Kamerman Labs, we offer you remarkably low prices. Finally, you can realize the full benefits of hard disk

technology without the excessive costs.

### Tested and formatted.

All Kamerman Labs systems have been thoroughly tested and formatted before delivery.

### Full warranty and technical support.

Kamerman Labs backs all its products with a full one-year warranty on both parts and labor. Plus you get prompt technical support through a toll-free hotline number.

**To order, call toll-free  
800-522-2237.**

**In Oregon, Hawaii and Alaska call  
503-626-6877.**

All Kamerman Labs units come in either internal or external configurations.

IBM is a registered trademark of International Business Machines Corp.  
Compaq is a trademark of Compaq Computer Corp.  
Corona is a trademark of Corona Data Systems.

Leading Edge is a registered trademark of Leading Edge Products, Inc.  
Eagle is a registered trademark of Eagle Computers.  
TAVA is a trademark of TAVA Corporation.

 **Kamerman  
Labs**

DEALER INQUIRIES CIRCLE 200 ON READER SERVICE CARD

CIRCLE NO. 225 ON READER SERVICE CARD

8054 S.W. Nimbus, Bldg. 6, Beaverton, Or 97005  
Phone 503-626-6877



ing as part of a team. Individual programmers benefit in several ways: first, using a Pascal formatter allows them to key in their code much more quickly than they would be able to if they were formatting it themselves. After all, the Shift key is hard to hit when blazing out code at high speeds, and complex programs require too much indenting to enter quickly (not to mention having to think about how much to indent). Programmers can type their code in lower-case letters and can be lazy or inconsistent about indentation if they desire. The formatter will take care of everything later.

Second, using a formatter helps programmers debug code. To see how, consider the following chain of events. First, a programmer writes a Pascal program and gets it to compile without errors. Then he runs it through the formatter to make it easy to read. If the program doesn't execute correctly, the formatted source code is easier to go through than the original, sloppy code.

Now suppose the programmer wants to change the program to add new features or fix old bugs. He inserts his code changes into the formatted source file, but types them at the left margin, in lower-case characters. It's easier to enter changes that way, and the changes stand out against the perfectly formatted remaining code.

Next he compiles his code, but he doesn't run it through the formatter yet. Instead, he tests the code first, to see if he has introduced any new bugs. If so, he can flip through a listing and easily spot the changes made since the last time the program worked. Once all the bugs are fixed, he can run the program through the formatter again.

A programming team gets the same benefits from using a formatter that an individual programmer does, plus one more—consistent coding style. Most programmers agree that proper formatting is important, but few agree on which

format is best. If everyone's code is run through a formatter, individual programmers can maintain their own unique coding habits, yet the final product is consistent. This is especially important for a programming team that uses code reviews as a means of checking the accuracy of code. If all of the code has been formatted with a utility prior to code review, the reviewers can concentrate on the code itself rather than on the idiosyncracies of style.



## THINGS TO REMEMBER

Using a Pascal formatter is easy if a couple of things are kept in mind: first, formatters can go through code quickly, but they are not as smart as compilers. They have to make some assumptions about the code, and one of the assumptions is that the code is free of compilation errors. If the program contains syntax errors, a formatter either will produce strange-looking output or (if the program is bad enough) will return an error message without producing any output at all.

Second, programmers should always save their original source code until they are sure the output produced by the formatter is correct. An inadvertent syntax error might cause the formatter to abort without producing an output file.

## TIDY

TIDY is a lightning-fast Pascal formatter from Major Software of Los Altos, California. It's inexpensive

(\$39.00), works with any version of DOS, and can format any programs written in IBM Pascal, Microsoft Pascal, or Turbo Pascal. It will run on any IBM PC (or compatible) that has at least 128K bytes of RAM.

TIDY has all the formatting features listed earlier: it capitalizes key words, enforces rules of spacing and indenting (indenting two spaces for each level), formats comments in special ways, enforces a maximum line length of 80 characters, and adds white space to make programs more readable.

The product formats comments consistently, making them easier to find and read in the listing. It uses three conventions: one for remarks, one for regular comments, and one for long comments. All comments beginning with exclamation points are considered to be remarks; these are the comments that can occur at the end of a line of code. TIDY starts all remarks at column 45 (or as close to column 45 as possible), regardless of where they are found in the original program.

Short comments are single-line comments that are delimited by braces or asterisks. TIDY places short comments on separate lines, no matter where they are placed in the original program. If the comment is too long, TIDY breaks it up into multiple lines.

Long comments are comments delimited by braces or asterisks that extend beyond a single line. TIDY starts a long comment on a new line, but it does not rearrange the text of the comment. This feature allows programmers to put comment delimiters around code that they don't want to compile but still want to save for reference.

Formatting can be turned off and on by including comments of the form `{*off*}` and `{*on*}`.

The documentation for TIDY consists only of a six-page listing



# **COHERENT™ IS SUPERIOR TO UNIX\* AND IT'S AVAILABLE TODAY ON THE IBM PC.**

Mark Williams Company hasn't just taken a mini-computer operating system, like UNIX, and ported it to the PC. We wrote COHERENT ourselves. We were able to bring UNIX capability to the PC with the PC in mind, making it the most efficient personal computer work station available at an unbelievable price.

For the first time you get a multi-user, multitasking operating system on your IBM PC. Because COHERENT is UNIX-compatible, UNIX software will run on the PC under COHERENT.

The software system includes a C-compiler and over 100 utilities, all for \$500. Similar environments cost thousands more.

COHERENT on the IBM PC requires a hard disk and 256K memory. It's available on the IBM XT, and Tecmar, Davong and Corvus hard disks.

Available now. For additional information, call or write,

Mark Williams Company  
1430 West Wrightwood, Chicago, Illinois 60614  
312/472-6659

CIRCLE NO. 164 ON READER SERVICE CARD



COHERENT is a trademark of Mark Williams Company.

\*UNIX is a trademark of Bell Laboratories.

CIRCLE NO. 186 ON READER SERVICE CARD



IBM PC USERS:

# TeamMate is breaking installation and performance records.

Let the TeamMate 1000 Series of Winchester and Kodak 3.3MB floppy subsystems set productivity records for your IBM PC or compatible. Taking only minutes to install, we've got all the competition beat. TeamMate requires no special software or formatting diskettes. All you need is DOS 2.0!

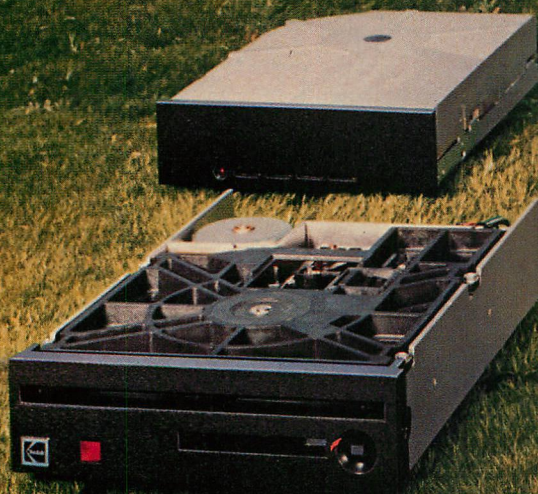
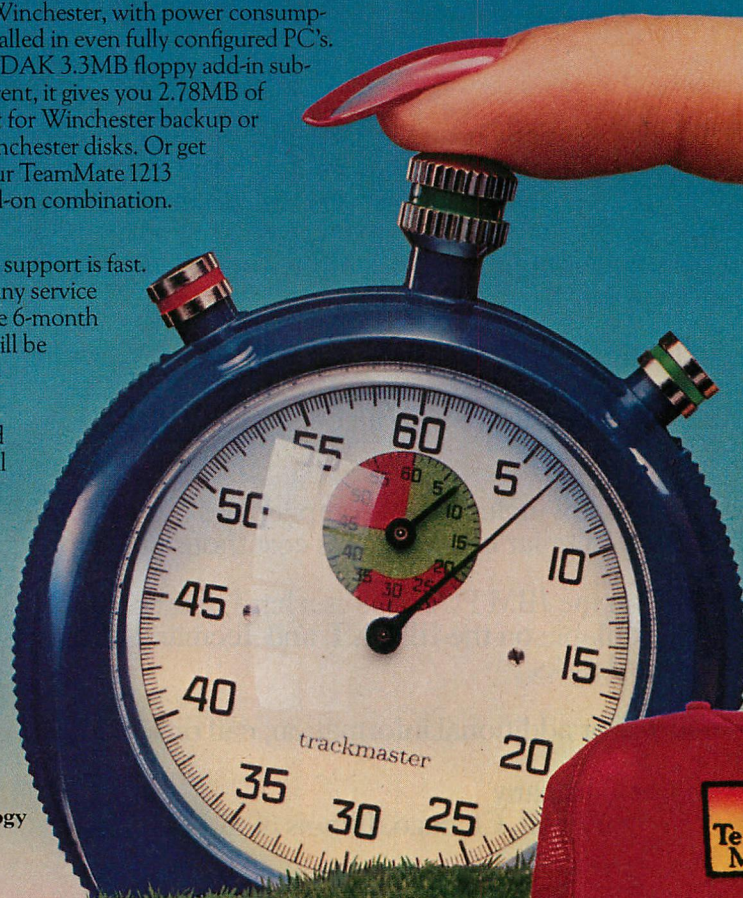
We have a variety of configurations to fill a variety of needs. Like the TeamMate 1110 add-in 10MB Winchester, with power consumption so low it can be safely installed in even fully configured PC's. Or try the TeamMate 1103 KODAK 3.3MB floppy add-in subsystem. Also software transparent, it gives you 2.78MB of rugged floppy storage—perfect for Winchester backup or as a low cost alternative to Winchester disks. Or get the advantages of both with our TeamMate 1213 Winchester/Kodak floppy add-on combination. All at record prices.

Even TeamMate's customer support is fast. Should your subsystem need any service during the first 3 months of the 6-month warranty period, your dealer will be shipped a swapout unit within **24 hours!**

Ask for TeamMate IBM and Apple subsystems at your local computer dealer. Or call us at (408) 496-0434.



TeamMate by Data Technology  
2775 Northwestern Parkway  
Santa Clara, CA 95051  
TEL: (408) 496-0434  
TWX: 910-338-2044



CIRCLE NO. 111 ON READER SERVICE CARD



# PASCAL

that resides on the TIDY diskette. More detailed documentation is, luckily, unnecessary. TIDY can be invoked simply by entering:

## TIDY source.tdy

The source.pas file is any Pascal source file, and the source.tdy file is a formatted source file produced by TIDY. The output file can be compiled immediately.

Programmers should be aware that TIDY allows the input and output file to be the same; if TIDY is invoked in this way, it writes the output file over the input file, destroying the original source code. This is inviting trouble, especially if the source code happens to contain syntax errors. Instead of formatting the code, TIDY might exit upon encountering the error, leaving the programmer with no code at all.

TIDY has a few bugs as well, but most of them are minor. For example, IBM Pascal allows the programmer to substitute square brackets for BEGIN and END. TIDY doesn't support that construction. It assumes that brackets are used only in array declarations, and if it finds them used in any other way, TIDY exits to DOS. The manual explains this restriction, and the people at Major Software have no plans to fix it. To handle the problem, TIDY would have to be almost as smart as the compiler itself.

Error-handling is also a slight problem. If for some reason TIDY is unable to handle the code it is fed, it exits to DOS and returns a run-time error message such as "stack underflow" or "stack overflow." It takes a while to interpret these messages to mean improper usage of brackets or too many levels of nesting. TIDY should handle these error conditions itself and return more meaningful error messages.

The people at Major Software are responsive when users point out problems with the program. When we reported some of the bugs we found, they fixed the problems

(with the exception of the bracket problem) and sent us a new version of the program in two weeks.

Aside from the minor bugs, TIDY does its job well and quickly. Figure 1 shows a 51-line unformatted program, and Figure 2 shows the same program after it was run through TIDY. Formatting the entire program took only eight seconds

(on a PC XT). We've run over 1,500,000 bytes of Microsoft Pascal source code through TIDY and are quite pleased with the results.

## PASCAL UTILITIES

Like TIDY, PASCAL UTILITIES is inexpensive—\$29.95. The package is made by Seven Valleys Software of Glen Rock, Pennsylvania, and

# TURBOCHARGE YOUR IBM PERSONAL EDITOR

Let **EDITOR-IN-CHIEF™** take charge. EDITOR-IN-CHIEF is our highly optimized key-definition profile for the IBM Personal Editor that saves you thousands of keystrokes. EDITOR-IN-CHIEF simplifies and speeds entry and editing of programs and text, dramatically increasing your productivity. More than forty new functions give you powerful control over your text or program files.

**With only one keystroke or key-combination, you can:**

- Mark or unmark a word or string of words
- Capitalize or lower case all text in the marked area
- Mark from the cursor to the beginning or end of the line
- Repeat the current line without marking it first
- Extend a marked block of lines up or down by one or more lines
- Get to the "unnamed" (error recovery) file
- Set tabs to provide for structured program indentation
- Automatically redefine the Enter key to any of five useful functions for entering or editing program or text files
- Save the current contents of the command line, for later reinvocation without retyping
- And much more.

We've adjusted and refined nearly every function in the IBM-supplied profile for improved usability. For example, functions meant to work in the data area (such as marking characters, blocks, and lines) work properly even when the cursor is on the command line.

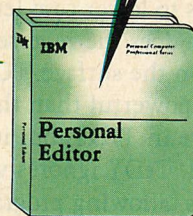
EDITOR-IN-CHIEF also includes an alternate profile, where you can custom-code your own key definitions. Predefined keys let you conveniently switch back and forth between the standard EDITOR-IN-CHIEF profile and your custom profile. We also include a complete online help facility, and an alternate help facility, where you can document your own key definitions.

# \$19.95



**POLYGON  
SOFTWARE  
CORPORATION**

EDITOR-IN-CHIEF comes with: diskette with profile and help file; reference card; complete installation and reference documentation.



363 Seventh Avenue, New York, New York 10001. Telephone: (212) 563-5487. Add \$2.50 postage and handling (NY residents add appropriate sales tax) Visa and Mastercard accepted.

IBM is a registered trademark of International Business Machines Corporation



consists of four programs: three that perform different aspects of code formatting and one that produces cross-reference listings. These programs work with either DOS 1.1 or 2.0, can process code written in IBM Pascal, and require only 64K bytes of RAM. The cross-reference program works well, but is not within the purview of this article.

The three utilities are called PSTRIIP, PRETTY, and PCASE, and each performs its own unique function. PRETTY handles the indenting of the text. It works much like TIDY does, with a few notable exceptions. First, it uses three spaces for each level of indentation; enough to cause a problem with "rightward creep." Second, PRETTY doesn't delete or adjust any of the spaces included in the code. Therefore, it doesn't adjust and standardize comments. Third, because PRETTY doesn't delete existing spaces, running the same program through PRETTY multiple times exaggerates the indentation each time. But that's where the second utility, PSTRIIP, comes in.

PSTRIIP strips off all leading spaces in the Pascal source code, making the code fit to run through PRETTY. Unless every line of the code being formatted begins at the left margin, PSTRIIP should always be used before PRETTY.

In the default situation, PCASE converts all Pascal reserved words to upper-case letters and all variable names to lower-case letters. Another option does the reverse.

On the surface, PCASE seems more powerful than the equivalent feature in TIDY, but it is really less useful. TIDY ignores variable names, allowing programmers to establish their own conventions (possibly using first caps for certain variables or all caps for constants); PCASE arbitrarily converts variable names. Also, PCASE has a nasty bug that causes it to crash, without returning an error message, whenever the source code contains comments

that begin with an exclamation point. This bug alone is enough to cause us to recommend against using PASCAL UTILITIES.

Like TIDY, PASCAL UTILITIES comes with only a few pages of documentation (a 17-page user manual). Unlike TIDY, however, some trial and error is necessary before users will be able to produce nicely formatted output with PASCAL UTILITIES.

To produce output similar to that produced by TIDY, programmers must first ensure that their code contains no comments that begin with exclamation points. After that is done, they can invoke the following commands:

**PSTRIIP source.pas source.pps**  
**PCASE source.pps -o**  
**source.cas**  
**Pretty source.cas source.pty**

The order of the commands is important. PSTRIIP should be run first to strip off all the leading blanks, then PCASE should be run, and finally PRETTY can be run; it must be run last, because the capitalization conventions established by PCASE tell it how to indent.

In general, the formatting programs in the PASCAL UTILITIES package do not work well. Not only do they have problems formatting comments, but PSTRIIP, PRETTY, and PCASE are slow—very slow when compared to TIDY. We tried the same sample program that we used with TIDY (except that we had to strip out all the comments with exclamation points). PSTRIIP, PCASE, and PRETTY took almost five times as long (39 seconds) to format the program, and they do not provide all of the formatting features that TIDY provides.

The error-handling facilities of the PASCAL UTILITIES are even worse than TIDY's. When we tried to format a program that used square brackets for BEGIN and END, the PASCAL UTILITIES produced an output file, but the for-

matting was entirely incorrect. In other situations, such as when it encountered comments beginning with an exclamation point, the PASCAL UTILITIES would crash without explanation, requiring a reboot.

Although the formatting utilities have problems, programmers might want to buy the PASCAL UTILITIES just for the other program—the Pascal cross-reference program. It's one of few products of its kind around, and it works.


## HOW THE OUTPUT LOOKS

Programmers have few options in telling a formatter how to format a program. Usually, the formatter produces code that looks one way, and one way only. So before buying a formatter make sure that its formatted output is acceptable.

Figure 2 shows the kind of output produced by TIDY; figure 3 shows output produced by the PASCAL UTILITIES package.

## RECOMMENDATIONS

A Pascal formatter is more than just a luxury to serious Pascal programmers. It not only makes code more professional-looking but also helps programmers spot structural errors, makes it easier for them to maintain their code, and increases their overall productivity.

Of the products we've seen, we feel that TIDY is the one that most programmers will prefer. 

### TIDY

*Major Software*  
 66 Sylvian Way  
 Los Altos, CA 94022  
 415-941-1924

\$39.00

CIRCLE 492 ON READER SERVICE CARD

### PASCAL UTILITIES

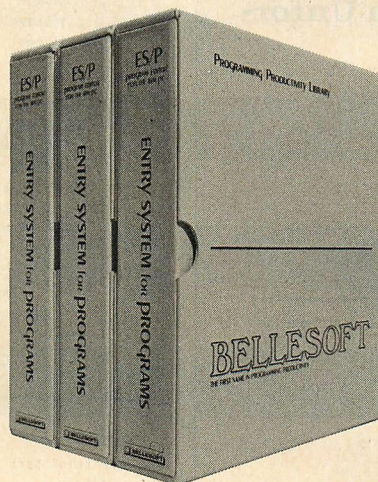
*Seven Valleys Software*  
 P.O. Box 99  
 Glen Rock, PA 17327  
 717-235-5470

\$29.95

CIRCLE 493 ON READER SERVICE CARD



# BELLESOFT HAS CHANGED THE WAY PROGRAMMERS WORK:



## PASCAL

## C

## COMPUTER AIDED PROGRAMMING

The Bellesoft Entry System for Programs (ES/P) has changed the way programmers will work in the future by putting computer aided programming (CAP) at their fingertips.

What word-processing programs did for writing text, Bellesoft has now done for generating programs: putting the computer to work to create a whole new way of writing software.

Bellesoft's ES/P speeds up software development by up to 50%, produces better programs and reduces debugging time. ES/P improves programming in five significant ways:

- 1. On-Line Syntax Checking.** ES/P is more than a very smart editor: it automatically checks your program for correct syntax as you enter or change it.
- 2. On-Line Formatting.** ES/P automatically provides a correct and consistent format, critical for program maintainability.
- 3. Context-Sensitive Abbreviations.** ES/P builds program structures or skeletons with a single keystroke, provides correct keywords and punctuation, and saves up to half your typing time.
- 4. Program Editing.** ES/P manipulates program structures correctly with a single keystroke, allows you to delete or move statements easily.
- 5. On-Line Programming Help.** ES/P provides menus of correct program components and correct syntax as an aid to faster programming.

ES/P is now becoming available to computer manufacturers for inclusion in their software packages; to distributors and dealers for resale; to universities and schools as an aid to teaching programming; and to programmers who want to cut their work in half while writing better programs.

CIRCLE NO. 114 ON READER SERVICE CARD

To order, contact: Lifeboat Associates  
1651 Third Avenue New York, NY 10028  
(800) 847-7078

## BELLESOFT

THE FIRST NAME IN PROGRAMMING PRODUCTIVITY  
(206) 828-7282



**Figure 1: MAJOR.SRC—An Unformatted Pascal Program**

```
{ Pascal Sort Program }

program sort(input,output) ;
const
max_entries = 5; !length of sort table
type
table = array [1..max_entries] of real;
var
sort_table : table; !table of numbers
i : integer; !table index
{*****}
procedure bubble_sort(var number_table: table); !bubble sort routine

{   This procedure sorts a table of numbers
{   by using the tried and tested but not
{   very fast bubble sort technique.   }

var
i:integer;!index
j:integer;!index
temp:real;!exchange variable
begin!bubble_sort
for i := 1 to max_entries - 1 do
begin
for j := i + 1 to max_entries do
begin
if number_table[i] > number_table[j] then!ascending order
begin
temp := number_table[i];!swap the table entries
number_table[i] := number_table[j];
number_table[j] := temp;
end;
end;
end;
end;!bubble sort
{*****}
begin!main program
writeln('Sort Program');!print title
writeln;
for i := 1 to max_entries do!loop to read in numbers
begin
writeln('Please input a number') ;!prompt for a number
readln(sort_table[i]);!read the number
end;
bubble_sort(sort_table);!sort the table of numbers
writeln;
writeln('The list of numbers in ascending order is:');
for i := 1 to max_entries DO!loop to print all the numbers
write(sort_table[i]:2:4, ' ');!write each number
END.!main program
```

**Figure 2: MAJOR.PAS—Listing 1's Program after Being Run through TIDY**

```
{ Pascal Sort Program }

PROGRAM sort(input,output) ;

CONST
    max_entries = 5 ;                !length of sort table

TYPE
    table = ARRAY [1..max_entries] OF real ;

VAR
    sort_table : table ;              !table of numbers
    i : integer ;                     !table index
{*****}

PROCEDURE bubble_sort(VAR number_table:table) ;!bubble sort routine
{   This procedure sorts a table of numbers
{   by using the tried and tested but not
{   very fast bubble sort technique.   }

VAR
```

```
    i : integer ;                    !index
    j : integer ;                    !index
    temp : real ;                     !exchange variable

BEGIN                                !bubble_sort
    FOR i := 1 TO max_entries - 1 DO
        BEGIN
            FOR j := i + 1 TO max_entries DO
                BEGIN
                    IF number_table[i] > number_table[j] THEN !ascen. ord.
                        BEGIN
                            temp := number_table[i] ; !swap the table entries
                            number_table[i] := number_table[j] ;
                            number_table[j] := temp ;
                        END ;
                    END ;
                END ;
            END ;
        END ;
    END ;

    !bubble_sort
{*****}

BEGIN                                !main program
    writeln('Sort Program') ;         !print title
    writeln ;
    FOR i := 1 TO max_entries DO      !loop to read in numbers
        BEGIN
            writeln('Please input a number') ; !prompt for a number
            readln(sort_table[i]) ;    !read the number
        END ;
        bubble_sort(sort_table) ;     !sort table of numbers
    writeln ;
    writeln('The list of numbers in ascending order is:') ;
    FOR i := 1 TO max_entries DO      !loop to print numbers
        write(sort_table[i]:2:4, ' ') ; !write each number
    END.                               !main program
```

**Figure 3: SVC.PAS—Listing 1's Program (Minus Comments that Began with Exclamation Points) after Being Run through PASCAL UTILITIES**

```
{ Pascal Sort Program }

PROGRAM sort(input,output) ;

CONST
    max_entries = 5;

TYPE
    table = ARRAY [1..max_entries] OF REAL;

VAR
    sort_table : table;
    i : INTEGER;
{*****}

PROCEDURE bubble_sort(VAR number_table: table);

{   This procedure sorts a table of numbers
{   by using the tried and tested but not
{   very fast bubble sort technique.   }

VAR
    i: INTEGER;
    j: INTEGER;
    temp: REAL;

BEGIN
    FOR i := 1 TO max_entries - 1 DO
        BEGIN
            FOR j := i + 1 TO max_entries DO
                BEGIN
                    IF number_table[i] > number_table[j]
                        THEN
                            BEGIN
                                temp := number_table[i];
```



```

        number_table[i] := number_table[j];
        number_table[j] := temp;
    END;
END;
END;
{*****}
BEGIN
    writeln('Sort Program');
    writeln;
    FOR i := 1 TO max_entries DO
        BEGIN
            writeln('Please input a number') ;
            readln(sort_table[i]);
        END;
        bubble_sort(sort_table);
        writeln;
        writeln('The list of numbers in ascending order is:');
        FOR i := 1 TO max_entries DO
            write(sort_table[i]:2:4, ' ');
        END.
    END.

```

## WATSOFTPRODUCTSINC

A subsidiary of the University of Waterloo

Announces

a full screen editor and a family  
of language interpreters for the  
IBM Personal Computer

**APL  
BASIC  
COBOL  
EDITOR  
FORTRAN  
PASCAL**

For further information contact:

WATSOFT Products Inc.  
158 University Ave.  
Waterloo, Ontario  
N2L 3E9

(519) 886-3700  
Telex No.: 06-955458

CIRCLE NO. 228 ON READER SERVICE CARD

## SoliDISK™ SAVES TIME.

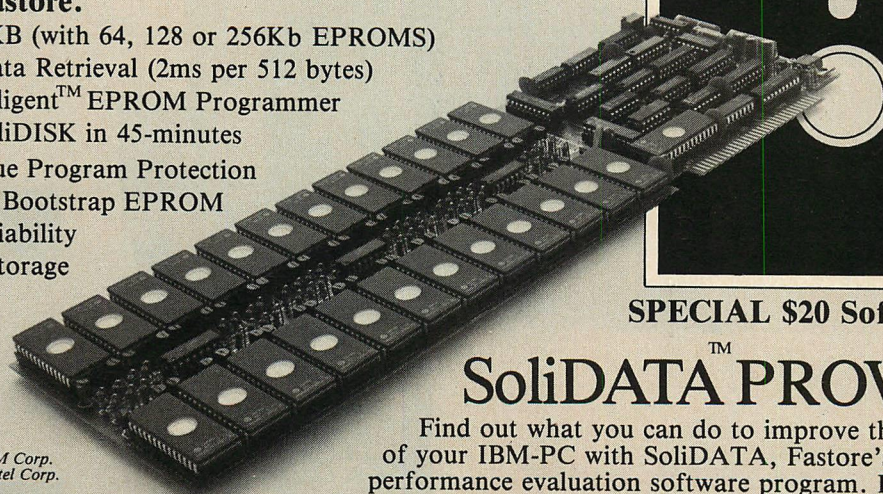
**SoliDISK...a solid-state, non-volatile storage  
system from Fastore.**

- ☐ 192KB to 768KB (with 64, 128 or 256Kb EPROMS)
- ☐ High Speed Data Retrieval (2ms per 512 bytes)
- ☐ On-Board Intelligent™ EPROM Programmer
  - Programs SoliDISK in 45-minutes
- ☐ Provides Unique Program Protection
- ☐ Optional Auto Bootstrap EPROM
- ☐ Solid-State Reliability
- ☐ Non-Volatile Storage
- ☐ Low power

IBM PC is a trademark of IBM Corp.  
Intelligent is a trademark of Intel Corp.  
Dealer inquiries invited.

Single-Density (192KB)	\$ 650
Double-Density (384KB)	\$1,250
Quad-Density (768KB)	\$2,500
Auto-Boot option	\$ 75
SoliDISK Eraser	\$ 95

\* Send check or money order to Fastore.  
Postage/Handling included.  
Send business card or call for free information.



**SPECIAL \$20 Software Offer**

## SoliDATA™ PROVES IT.

Find out what you can do to improve the performance  
of your IBM-PC with SoliDATA, Fastore's powerful new  
performance evaluation software program. It allows you to  
analyze DOS commands, monitor file utilization and quantify the  
performance of floppy and hard disks as compared to SoliDISK.

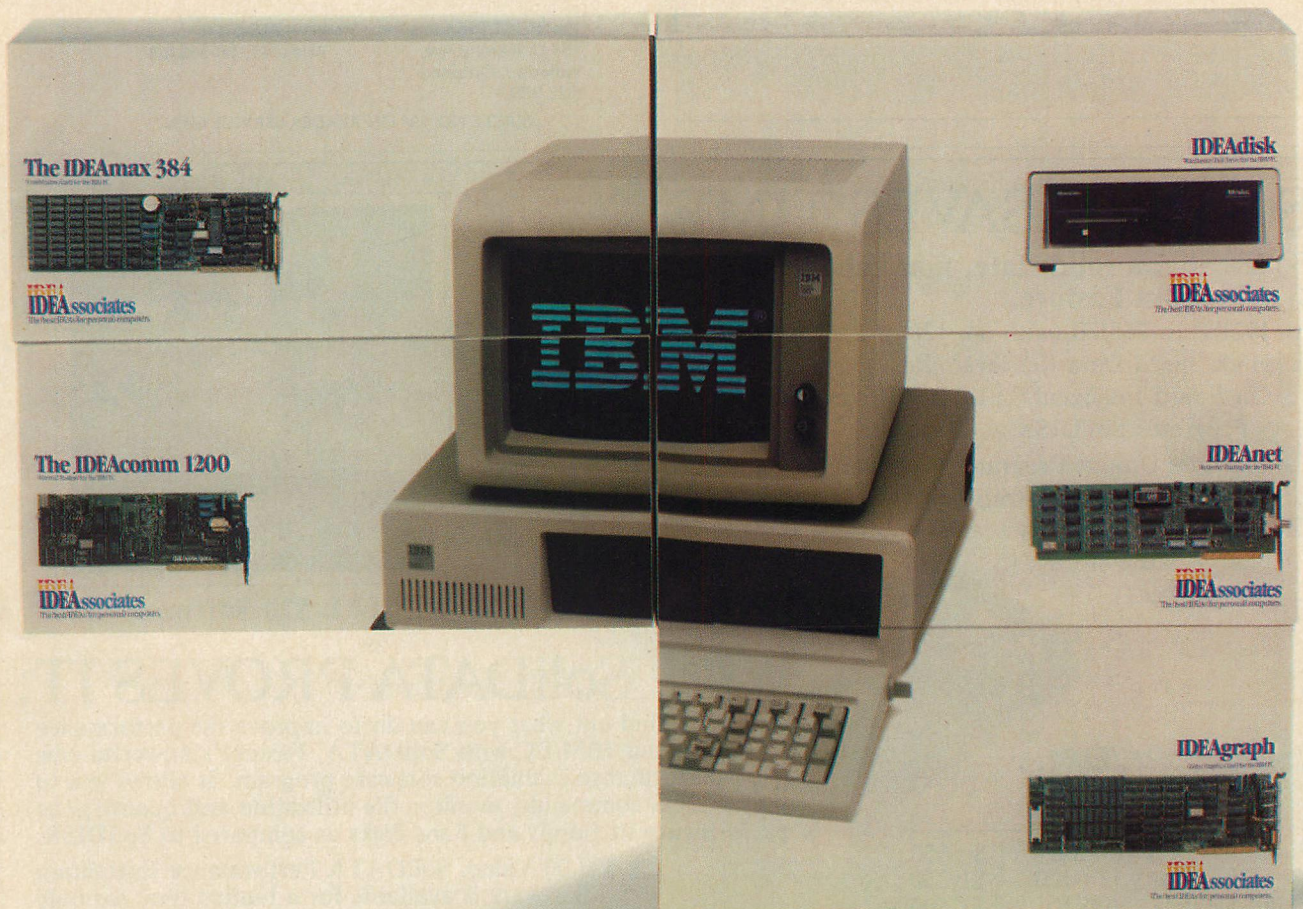
A \$79.00 Value, SoliDATA Performance Evaluation  
Software is available for a limited time for only  
\$20.00.\* Money back if not fully satisfied.

**FASTORE**

200 Danbury Road • Wilton, CT 06897 • 203-834-1975



# We have a missing piece for your IBM PC.





# Forget IRMA. Here's IDEAcomm 3278. The best idea in mainframe communications.



The IDEAcomm 3278 gives you all the functionality of your IBM PC, plus direct access to mainframe information and applica-

tions. Without having to deal with two terminals.

But how does IDEAcomm 3278 stack up against IRMA? Well, you know IRMA has a reputation for being fast. But the IDEAcomm 3278's powerful file transfer moves data faster. Up to 60% faster.\* So response time is nearly instantaneous.

Our file transfer is real file transfer. You can spool files from the mainframe to the PC and back again by hitting just one key. One key to send a file, one key to receive a file. Not IRMA. She sends you jumping through hoops to use her file transfer.

IRMA also has a reputation for being flexible. IDEAcomm 3278 is more flexible. You can specify how to change the 3278's programmable keys to best suit your applications. And our 3279 emulation mode lets you configure colors any way you want. Again, the IDEAcomm 3278 lets the user decide. You'll find IRMA likes to make her own decisions.

The IDEAcomm 3278 makes life easier for your data processing department, too. Included in our reference manual is a programmers' section which outlines how to automate functions which previously had to be performed manually.

Are you getting the idea that the IDEAcomm 3278 is a lot more than a plug-in card? You're right. Other features include:

- 100% compatible with Micro Tempus and Paramin mainframe link packages.
- IDEAcomm 3278 interfaces to IBM 3274, 3276 controllers.
- Includes TSO and VM/CMS file transfer.
- File transfer sends all text files to the mainframe. HEX files can be sent to the host, then spooled to other users.

Best of all, IDEAcomm 3278 costs less. Only **\$995** including software. There are no hidden charges.

Ask for IDEAcomm 3278 and the entire IDEA family of products at all Computer Depot, Math Box, Ameri-source, and Northeast Computer stores, plus selected Computerland, Inacomp, and MicroAge® locations. For the name of the IDEA store nearest you, call us at **800-257-5027**.

See why the best IDEA in mainframe communications is the piece you've been missing for your PC.

\*In benchmark studies, IDEAcomm 3278 transmission speed on a local mode 3274 was up to 60% faster than IRMA.

CIRCLE NO. 136 ON READER SERVICE CARD

**IDEA**  
**IDEA**ssociates

**The best IDEAs for personal computers.**

IDEAssociates, Inc., 7 Oak Park Drive, Bedford, MA 01730 (617) 275-4430 Telex 94-8245. IDEAssociates S.A., 5, Route de Chêne, CH1207 Geneva, Switzerland (22)86.11.19 Telex 428 388 KBSCH











# DOS SHELLS

C O N T I N U E D

ARTHUR A. GLECKLER

*DOS Commander and DOS Ease succeed in making PC-DOS somewhat more enjoyable to use; DOS Shell does not, although it can help organize the XT's fixed disk.*

PC-DOS is a well-thought-out, practical operating system, but it is certainly neither easy to use nor friendly. Novice users often find it difficult to understand, much less to use effectively. Even experienced computer users find PC-DOS's syntax and command structure confusing and, at times, frustrating.

Enter shells. Shells are programs that "surround" the disk-operating system and provide their own syntax and methods of operation, different from the original DOS methods. By hiding the details and intricate syntax of DOS, a good shell reduces confusion and increases the efficiency of the user. In this article three shells for PC-DOS are reviewed: DOS Commander, DOS Ease, and DOS Shell.



# DOS SHELLS

## DOS COMMANDER

DOS Commander, from Applitek, Inc., works only with PC-DOS 2.0. The package includes an instruction manual and two versions of the program, one for color displays and one for monochrome displays. Both versions work exactly alike, except that the color version makes use of the IBM Color Graphics Adapter to provide a more attractive display.

When DOS Commander is invoked, it sets up a full-screen display that is divided into three windows and a command area (see photo 1). On the left side of the screen is a diagram that represents the arrangement of the function keys on the PC keyboard. A description is placed over each key.

DOS Commander uses the Shift and Alt keys in combination with the function keys to increase the number of available functions to 30. Normally, the functions are labeled RUN, COPY, TYPE, FORMAT, ERASE, RENAME, PRINT, MODE, DIR, and HELP. When the Shift key is pressed, the functions change (on the display) to DISKCOPY, DISKCOMP, VERIFY, TREE, RESTORE, CHDIR, MKDIR, COMP, SET TIME, and SET DATE. And finally, when the user presses the Alt key the labels change to F1.BAT through F10.BAT.

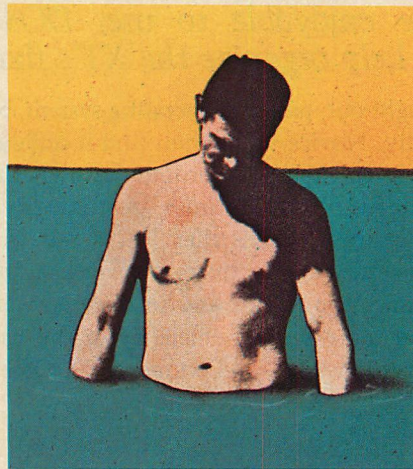
The middle window of the DOS Commander display lists the files in the current directory and their sizes (in bytes). If more than 19 files are present, "PgDn" appears at the bottom of the list to indicate that the PgDn key can be pressed to see the next 19 files. The up and down arrows on the numeric key pad can be used to position a marker over a file name in this list, and the Ins key is used to copy that file's name onto the command line (more on this later in the article).

The right window is the system status window. It contains the current date and time (both are constantly updated), the drive letter of the default disk, the number of files

in the current directory, the number of bytes free on the disk, the volume ID of the diskette, amount of total memory (both installed and free), and the status of the Caps Lock and Num Lock keys.

Under the three windows is the command area. This area consists of three lines of text. On the first line the name of the current directory is displayed. User commands are typed on the second line (after the traditional "A>" prompt), and the third line always contains a brief message explaining what to do next.

There are three basic types of actions that the DOS Commander



user can take: press a function key, select a file in the current directory with the cursor keys, or simply type a DOS command. Through DOS Commander, users can construct command lines for DOS to act upon. Pressing a function key brings the command on that key to the command line and causes a brief (one-line) explanation of how to use the command to appear on the 25th line. Pressing the Ins key brings to the command line whatever file is indicated by the directory marker. Finally, pressing the Enter key causes the constructed line to be sent to DOS for execution.

Suppose, for example, that a DOS Commander user wants to copy a file. First, the user presses F2 (which is labeled COPY in the function key window). This causes

"COPY" to appear on the command line, and the message "Copy a file: Enter 'from' filename followed by 'to' filename" to be displayed. Next, the user types the name of the file to copy from (including wildcards, etc., because DOS Commander places no restrictions on program arguments). This name is followed by a space and then the name of the file to copy to (again, including wildcards if desired).

Once the command line has been entered, the user presses the Enter key to have the entire line executed. DOS Commander simplifies the process by giving help messages, but it does not eliminate the need to understand PC-DOS syntax; all program parameters are still entered in standard PC-DOS form.

Although DOS Commander is designed for construction of command lines that are to be sent to DOS, it does not provide facilities for editing these lines (other than by using the backspace key). This is an unfortunate omission, because the only way a mistake can be corrected is by retyping a line.

Function key 1, labeled "RUN" in DOS Commander, is used to execute the program currently indicated by the directory marker. The user simply moves the marker to the program file name in the directory (using the up and down arrow keys) and presses the RUN key to execute the program. The same effect can be achieved by typing the name of the program (exactly as under PC-DOS) or by using the Ins key to bring the program's name to the command line; the RUN key is provided only to speed up the process of executing a program.

Function key 10, labeled "HELP," is used to display general information on how to use DOS Commander. Pressing HELP causes the file HELP.BAT to be executed; the program displays four screens of information, pausing on each screen to wait for the user to press a key. HELP.BAT and HELP1.TXT





# Discover Solutions With Vision

Dealers are finding Pacific Datamet's Vision™ hard disk sub-systems are today's personal computer users' choice for mass storage sub-systems.

The Vision Series is more than illusionary — read on!

**Capacity** A variety of sub-systems — 12/10Mb, 19/17Mb, 26/21Mb, 40/32Mb, 50/43Mb, 70/62Mb, 105/92Mb, and 140/125Mb.

**Software** Menu-driven software makes installation simple with the IBM PC, XT, or IBM compatible.

**Complete Sub-System** Vision Series are complete. Sub-systems include a 5¼" Winchester, our controller, host adapter, heavy duty international power supply, software and cables.

**Fast Tape Backup** 5¼" ¼" tape streamer backs up at a consistent 5Mb per minute, using standard 90 ips, ¼" tapes.

**Error Correction** Sub-systems provide 8 bit error correction.

**Reliability** Stringent quality control assures reliable operation.

**Price** Prices start at \$2,195 for the hard disk sub-system, and \$1,995 for the streaming tape backup.

Dealer Inquiries Invited  
**PACIFIC DATANET, LTD.**  
4701 Patrick Henry Drive, Bldg. 9  
Santa Clara, CA 95054  
(408) 980-0693 Telex: 759341

\* VISION is a trademark of Pacific Datamet, Ltd.  
\* IBM is a trademark of International Business Machines Corp.  
CIRCLE NO. 169 ON READER SERVICE CARD



## Pacific Datamet



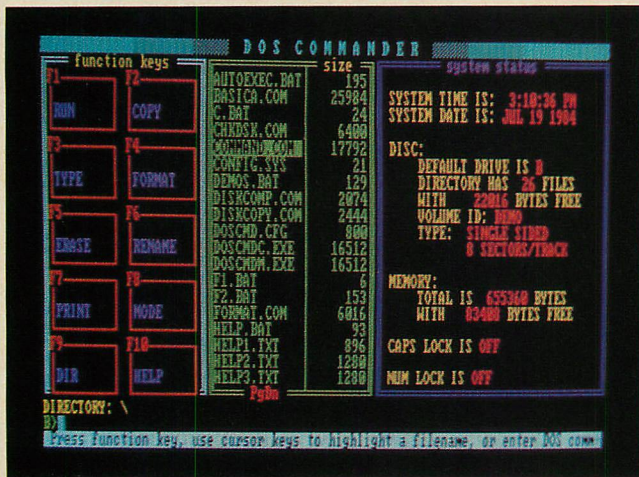


Photo 1: DOS Commander Status Screen

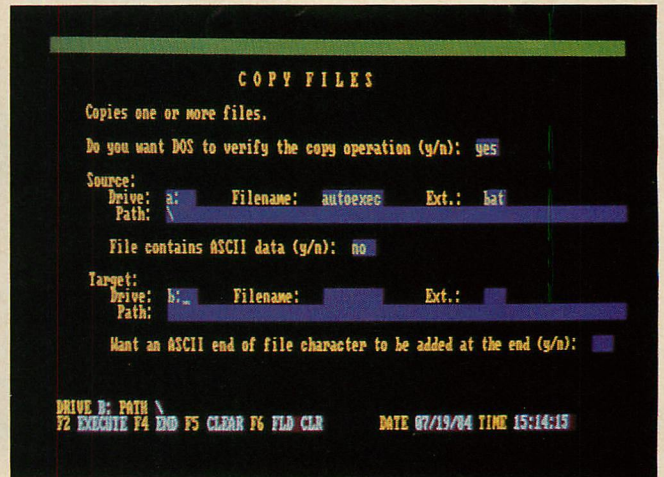


Photo 2: DOS Ease "COPY FILES" Function Screen

through HELP4.TXT, which contain all of the help information, must be in the current directory in order for HELP to work.

DOS Commander's authors have provided an easy method to extend the program to suit individual users' needs. If the Alt key is held down while a function key is pressed, one of 10 batch (.BAT) files will be executed. These files, named F1.BAT through F10.BAT, can contain batch programs to handle operations that are used often. For example, if a popular integrated business program is used frequently by a DOS Commander owner, the file F1.BAT could contain

```
C:DOITALL /WORD
/CALC /COMM /BASE
```

making the process of starting the program quicker and easier. Note that the batch files must be in the current directory for this to work.

The DOS Commander manual specifically states:

DOS COMMANDER also requires the presence of a special file called COMMAND.COM to be [sic] on the disc from which COMMANDER is initially started, typically Drive A. Even if you direct DOS COMMANDER to Drive B (by typing B:) COMMAND.COM needs to be on the disc that is in Drive A.

This is not the full story. While testing DOS Commander, I found that the program will not operate

unless COMMAND.COM is in the root directory of the default drive at all times. Even after DOS Commander finds COMMAND.COM on the default drive, however, it looks for COMMAND.COM on the boot drive (A for floppy systems, C for XT). Thus, contrary to what the manual says, COMMAND.COM must be both in the root directory of the default drive *and* in the root directory of the boot drive.

DOS Commander also requires that all programs to be executed—including DOS utilities such as FORMAT and MODE—be in the current directory on the default drive. If the FORMAT function key is pressed and FORMAT.COM is not in the current directory, DOS (not DOS Commander) will return the "Bad command or file name" message. This will also happen if the user tries to invoke any DOS utility not in the current directory. This defeats the purpose of DOS Commander, which is to make the operating system easier to use.

A reasonable solution to this problem would be for Applitek to change DOS Commander so that it would search for DOS utilities that appear on the function keys in a predesignated drive and directory (that is, in the root directory or on drive A). This improvement would allow the user to change directories without losing the DOS utilities.

DOS Commander users can take matters into their own hands and set up directory search orders using the PATH command from DOS. This is not an ideal solution, however, for two reasons: first, most novice users (the primary users of DOS Commander) probably will not know how to set up a PATH. Second, considerable time can be spent waiting for DOS to find a program that could be in any directory in the search path, as well as in the default directory.

Although the DOS Commander system-status window displays the volume ID of the default disk, it does not do this with reliability. When presented with several disks that had volume IDs accepted by PC-DOS, DOS Commander displayed either garbage or a "(none)" message. This is not a major hindrance, but it is a problem.

The DOS Commander documentation is very short (18 pages) but complete. Except for its discussion of the problem with COMMAND.COM mentioned earlier, the manual is accurate and easy to understand, although its writing style leaves something to be desired.

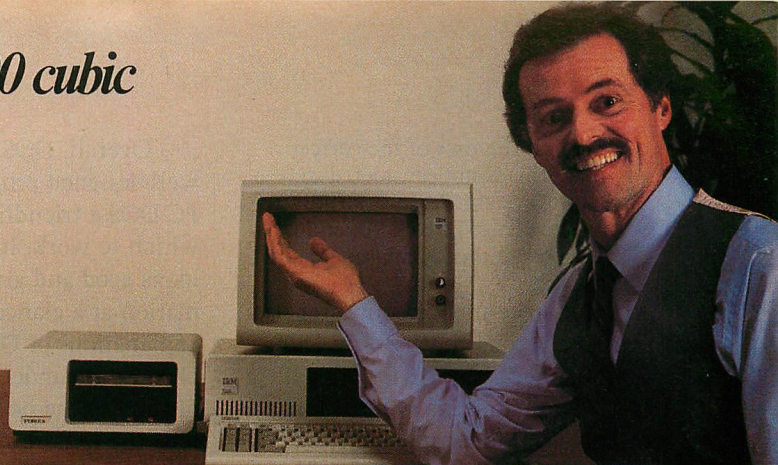
The manual gives an accurate and honest summary of DOS Commander's usefulness.

Although DOS COMMANDER does provide prompts for DOS commands invoked by the function keys



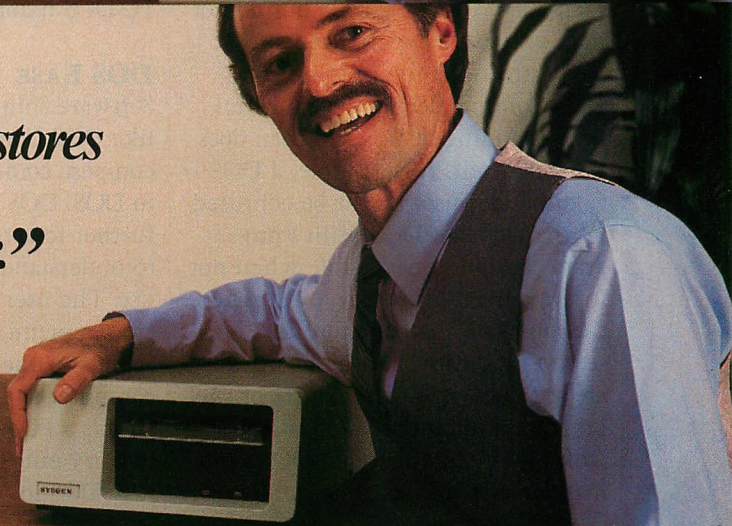
*"My computer keeps track of 135,000 cubic feet of wholesale auto parts."*

The more work you do, the more you need to store. And the harder it is to work with stacks of floppy diskettes.



*"My Sysgen hard disk stores the whole lot and runs a whole lot faster."*

Sysgen-II-G™ hard disk systems store everything—up to 20 Megabytes—conveniently. You can look at any program or file in seconds. But...



Any hard disk can fail—and lose your information. So every Sysgen-II-G hard disk includes 1/4" cartridge tape back-up—up to 20 Megabytes per cartridge. (We make back-up systems for other hard disks, too.) So you can protect your files in minutes. Instead of spending hours re-entering them.

*"And this lets me sleep at night."*



## Sysgen. Because a hard disk without tape just doesn't make sense.

Sysgen products for the IBM® PC, PC XT™, and other personal computers: Economical, 10- and 20-Megabyte hard disk systems with tape back-up. Or 10-Megabyte

tape back-up for the IBM PC XT.

Go to your local computer dealer. Ask for a demonstration of Sysgen back-up systems. And find out how to make sense of your storage.

47853 Warm Springs Blvd., Fremont, CA 94539  
(415) 490-6770 Telex 4990843



# SYSGEN

INCORPORATED

IBM PC-XT and IBM PC are trademarks of International Business Machines Corporation. SYSGEN-II-G and IMAGE are trademarks of Sysgen, Incorporated.



## DOS SHELLS

to remind the user of the correct syntax, this is not considered to be a teaching system. At least a rudimentary knowledge of DOS functions and access to the DOS Users manual is suggested.

Although the novice computer user could be just as confused by DOS Commander as by PC-DOS itself, DOS Commander is helpful for those who understand the fundamentals of using PC-DOS but do not have extensive experience using it.

Unfortunately, in some cases, DOS Commander requires a better understanding of PC-DOS than does PC-DOS itself. For example, a DOS Commander user might be confused by the fact that DOS utility programs become unavailable when not in the current directory, even when the labels on the function keys seem to indicate that the utilities are still available. The nature of the program is such that DOS utilities look like integral parts of DOS Commander, not like separate programs.

Overall, DOS Commander is a well-designed program that makes PC-DOS a friendlier environment in which to work. Its screen display looks good and gives a lot of information at a glance. In addition, the explanations of DOS functions that DOS Commander provides are simple and to the point, and they provide the extra hints needed to make PC-DOS usable by novices.

### DOS EASE

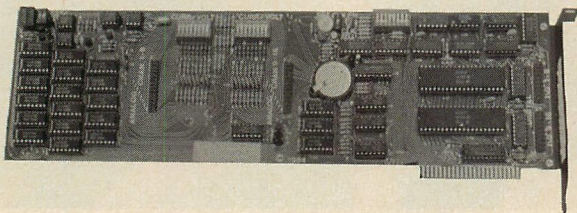
Software Solutions, Inc.'s DOS Ease, like DOS Commander, is used to compose command lines to be sent to DOS. DOS Ease, however, goes further toward eliminating the need to understand complicated DOS syntax. The user selects a function from a menu of 32 choices and responds to questions about what the computer should do. DOS Ease constructs a PC-DOS 2.0 command line to carry out the operation and sends it to DOS for execution.

The main screen of DOS Ease is divided into six sections, each dealing with a different type of DOS function: FILE, DISK, DIRECTORY, SYSTEM, FIXED DISK, and OTHER. Each section contains brief, numbered descriptions of different functions. The lower right-hand corner of the screen displays the date and time continuously, and the lower left-hand corner shows function key assignments (F1 displays one page of help information, F4 exits DOS Ease, and F6 cancels the current function).

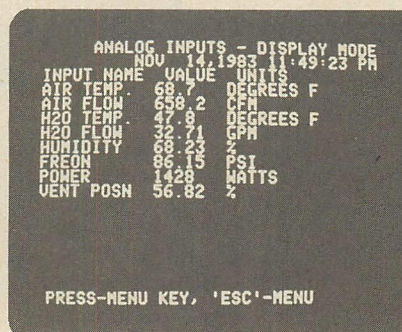
When the main screen is displayed, the user enters the two-digit number that corresponds to the function that he wants. DOS Ease immediately displays a screen full of questions and helpful information concerning that particular function. The questions are presented as a form to be filled out by the user, with a blank for an answer located next to each question.

# DATA ACQUISITION and CONTROL

## Ready To Use System



**8 to 192 ANALOG INPUTS and  
8 to 192 Digital Input/Outputs**



**Comprehensive  
menu driven  
SOFTWARE**



**FREE unlimited  
assistance from  
our experts**

**ANALOG CONNECTION PC for IBM — ANALOG CONNECTION II for Apple**  
Start datalogging and controlling in just one hour using menus! No Programming Required. Easily measure temperature, pressure, voltage or current. Most sensors connect directly without special modules. Ranges from 50mV to 10V and 5mA to 50mA with 14 bit (.006%) resolution. Compensation for 10 different thermocouple types included. Starts at \$490 for Apple, \$690 for IBM.



IBM PC & XT are trademarks of IBM Corp.

Apple is a trademark of Apple Computer, Inc.

Inspector Free Soul

**Strawberry Tree Computers • 949 Cascade Dr. • Sunnyvale, Ca. 94087 • (408) 736-3083**



CIRCLE NO. 176 ON READER SERVICE CARD





## You've seen the Macintosh, now see PC Paintbrush

### PC Paintbrush

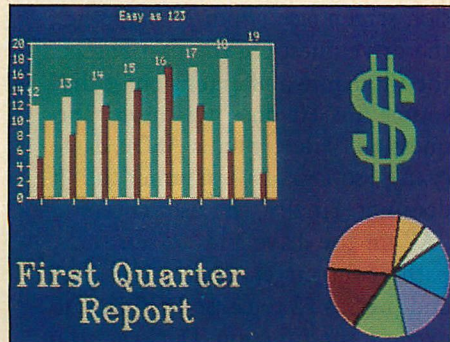
After many months of testing, ZSOFT Corporation is pleased to announce the versatile, colorful, PC Paintbrush.

Not just 2 colors, but 4, 16, or even 256 colors. Not just 320x200 resolution, but 640x200, 640x400, 720x350, 720x704, or more (depending on display adapter).

PC Paintbrush is available NOW for the IBM PC and compatibles, with 192K of memory and DOS 2.0 or above. We support an astonishing variety of hardware; check the lists below. Soon: HPI50 and Corona 640x325 versions.

### For Business, too

Besides being lots of just plain fun, we've designed PC Paintbrush for serious business. Our character sets (all 6 of them) are the best looking in the industry. Our printout is second to none.



Want to improve humdrum bar graphs? With PC Paintbrush, you can grab a chart or graph from another program (such as Lotus' 1-2-3 or Soreim's SuperCalc3), then

embellish it with PC Paintbrush. Take a plain 2 or 4 color bar graph and produce a stunning 16 color slide or printout (requires appropriate display adapter).

We offer special group licensing agreements, as well as inexpensive customization services for your business' special requirements.

### Astonishing Resolution

No need to buy additional hardware. We've made sure that PC Paintbrush will work with your printer, your display, and your application.



You can print on B/W printers from IBM, Epson, NEC, Okidata, C-Itch, and Gemini; or color printers from Diablo, Tektronix, PrintaColor, Hewlett Packard (HP7475 Plotter), Quadram, and Transtar. With the color printers, pick from 25 different colors. With black and white printers, pick from 16 different shading patterns. Color printers never looked so good.

The display possibilities with PC Paintbrush are equally amazing. We COM-

PLETLY support display cards by Amdek, Quadram, Tecmar, Hercules, IBM, Mindset, Scion, and even the PCjr 16 color display. Just imagine 640x480 resolution in 16 brilliant colors (that's 9 times the resolution of the IBM color card!), or 720x704 resolution in 3 shades of grey.

### Blinding Speed

You hate waiting and so do we. All of our graphics are written entirely in assembler, for the fastest possible results.

### We provide Products, not Promises

No promises, just fact: we are currently shipping PC Paintbrush.

All ZSOFT software comes with a real warranty, and our service is second to none. Just ask some of our customers (such as IBM, Sohio, Michelin, Salomon Bros., Sperry, Westinghouse, U. of Pittsburgh . . . shall we go on?).

For those interested in updates, a single small fee entitles you to updates for one year; no catch; no additional costs, no need to return diskettes, no postage fees.

### Schools

Schools and universities please call for educational discounts.



# Z·SOFT

370 HERMITAGE CT. SW  
MARIETTA, GEORGIA 30064 • 404-425-3766  
MacIntosh is a registered trademark of Apple Co.  
PCjr. is a registered trademark of IBM.



# The Preferred C Compiler

**"...C86 was the only compiler we tested that ran every benchmark we tried and gave the expected results... Computer Innovations C86 was the compiler that our staff programmers used both before and six months after we conducted the tests."**

**J. Houston, BYTE MAGAZINE - February 1984**

**\*FAST EXECUTION -**  
of your programs.

**\*FULL & STANDARD IMPLEMENTATION OF C -**  
includes all the features described by K & R. It works with the standard MSDOS Linker and Assembler; many programs written under UNIX can often be compiled with no changes.

**\*8087 IN-LINE -**  
highly optimized code provides 8087 performance about as fast as possible.

**\*POWERFUL OPTIONS -**  
include DOS2 and DOS1 support and interfaces; graphics interface capability; object code; and librarian.

**\*FULL LIBRARY WITH SOURCE -**  
6 source libraries with full source code the "large" and "small" models, software and 8087 floating point, DOS2 and DOSALL.

**\*FULL RANGE OF SUPPORT PRODUCTS FROM COMPUTER INNOVATIONS -**  
including Halo Graphics, Phact File Management, Panel Screen Management, C Helper Utilities and our newest C to dBase development tool.

**\*HIGH RELIABILITY -**  
time proven through thousands of users.

**\*DIRECT TECHNICAL SUPPORT -**  
from 9 a.m. to 6 p.m.

Join The Professional Programmers Who Agree C86<sup>TM</sup> Is The C Compiler Of Choice

For Further Information Or To Order Call:

**800-922-0169**

Technical Support (201) 542-5920

980 Shrewsbury Avenue  
Suite PW509  
Tinton Falls, NJ 07724



**Computer Innovations, Inc.**

# C86<sup>TM</sup>

PRICE SUBJECT TO CHANGE WITHOUT NOTICE.  
UNIX IS A TRADEMARK OF BELL LABS. C86 IS A TRADEMARK OF COMPUTER INNOVATIONS, INC. MSDOS IS A TRADEMARK OF MICROSOFT.  
PC DOS IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINES.

## DOS SHELLS

In the lower left-hand corner of each function screen, function key assignments are displayed. These assignments are the same for all DOS Ease functions. They are:

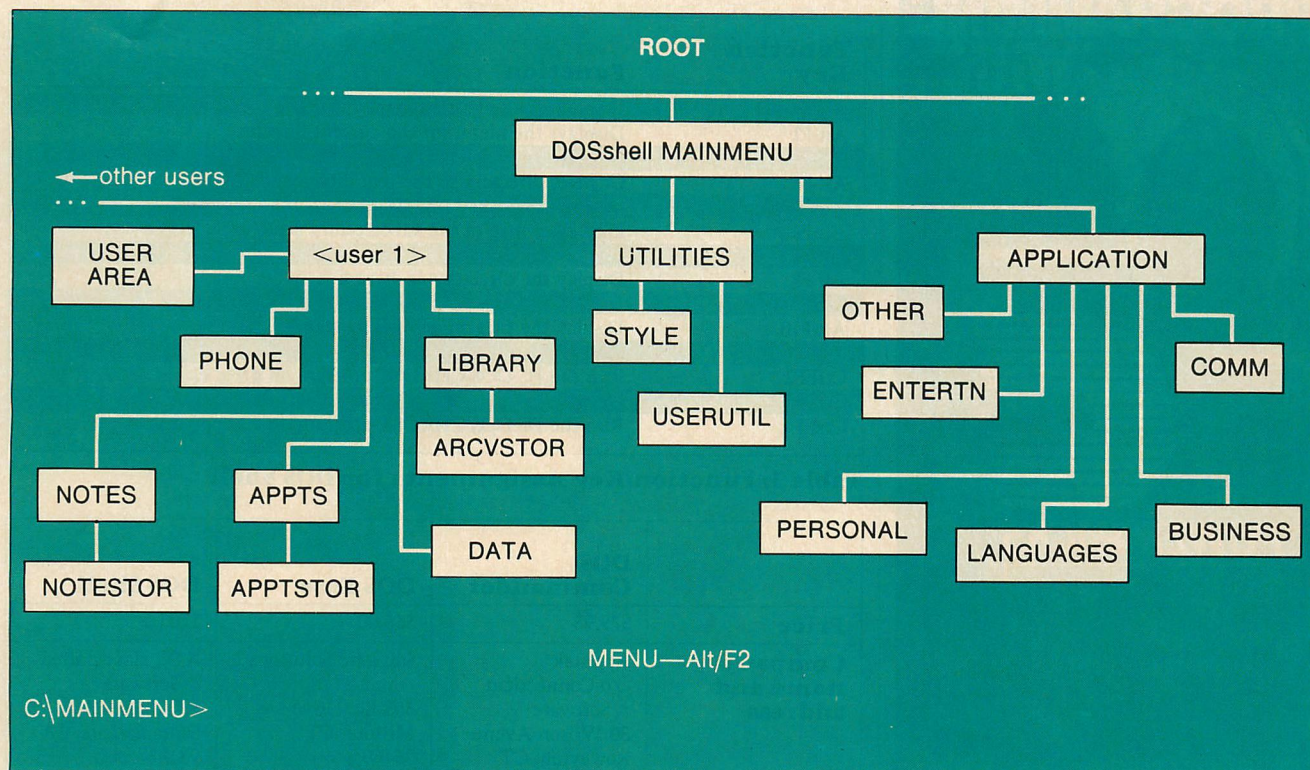
- F2—carry out the function;
- F4—cancel the function and return to the main screen;
- F5—clear the answer area of the current question;
- F6—clear the answer areas of all questions.

There is no special help key on the function screens; all information on the current function is displayed adjacent to the questions.

A question is answered by moving the cursor (using the arrow keys and Enter) to the corresponding answer area and typing an answer. DOS Ease asks every possible question about each function, leaving no parameter unaccounted for. Not every question requires an answer. All unanswered yes/no questions default to "No" responses. However, if the user presses the F2 EXECUTE key without answering an essential question (such as the name of the file for the RENAME command), DOS Ease will respond with the message, "This field must be filled"; the program will then position the cursor over the neglected question and wait for a valid answer.

The process of copying the DOS Ease program from the current directory to the root directory in drive A: can serve as an example of DOS Ease operation. From the main screen, the user selects the "Copy files" choice in the FILE section by typing "12." The main screen is replaced by the "COPY FILES" function screen (see photo 2). Skipping the drive question, the user enters the file name and extension of the source file. He does not answer the question "File contains ASCII data (y/n)," so DOS Ease assumes that it does not. Finally, the user enters "A" for the drive and "/" for the path of the target (destination) file, and presses F2 to cause DOS Ease to execute the function. DOS Ease con-





**Figure 1: DOS Shell Subdirectory Map**

structs the following command line and sends it to DOS:

**COPY disease.exe /B a:\\* /B**

DOS Ease, like DOS Commander, requires that DOS utilities (FORMAT, CHKDSK, etc.) be in the default directory whenever they are used or be accessible via a directory search order defined through the PATH command. DOS Ease requires only one copy of COMMAND.COM to operate; this should be present in the root directory of the boot disk.

The DOS Ease manual is well written and complete. It clearly explains the purpose of the program and how to install and use it. The documentation includes a glossary of PC-DOS terminology and a map of DOS Ease keyboard layout.

DOS Ease makes it almost impossible for an illegal command syntax to be sent to DOS. It ensures that all essential questions are answered, checks the user's answers, and explains all parameters clearly and simply. In addition, DOS Ease

can carry out virtually any function that DOS can (from changing the date to setting the status of BREAK). DOS Ease considerably eases the process of interacting with PC-DOS. Although it does not speed up DOS use for experienced users as DOS Commander can, DOS Ease does an excellent job of isolating the user from the complexity of PC-DOS.

### DOS SHELL

DOS Shell, from XTC Handcrafted Software, is different from the shells discussed above. It is designed for use only with fixed-disk systems (that is, XTs or PCs with the expansion chassis or compatible fixed-disk drives) under PC-DOS 2.0. DOS Shell makes no attempt to isolate its user from PC-DOS command-line syntax; rather, it enhances PC-DOS by organizing the fixed disk into subdirectories and "user areas" and making it easy to move between them. DOS Shell is not a program as such; it is a collection of batch files and one BASIC program that makes a fixed disk easier to use.

DOS Shell can be installed on a fixed disk, whether or not the disk is empty. During installation, it creates subdirectories and places help files and batch programs in each subdirectory (figure 1 shows the structure of the subdirectories).

To use DOS Shell, the user must insert the command

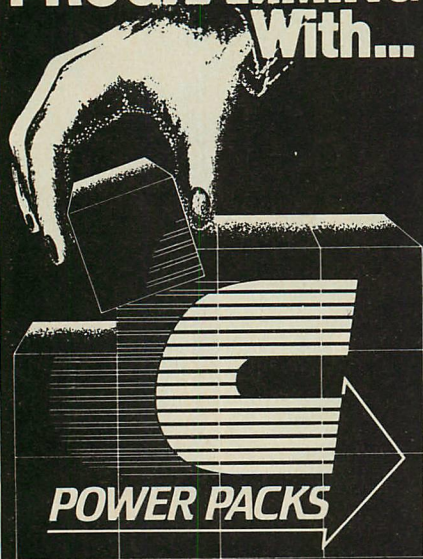
**device = ANSI.SYS**

into the CONFIG.SYS file. One use for the ANSI.SYS program is to allow programs to redefine the function of any key on the keyboard (see "Defining Function Keys Using ANSI.SYS," PC Tech Journal, March 1984, page 77). DOS Shell makes use of ANSI.SYS to change the assignments of the function keys, as shown in table 1.

Using DOS Shell involves pressing function key combinations to arrive at a subdirectory, then executing a batch file. The batch files in each subdirectory are 1.BAT, 2.BAT, etc., so that the user must press only a numeric key and Enter in order to activate a function.



# SPEED UP PROGRAMMING With...



- **PACK 1: Building Blocks I** Object \$99  
250 Functions: DOS, Printer, Video, Asynch Source \$149
- **PACK 2: Database** Object \$149  
100 Functions: B-Trees, Source \$Call  
Variable Records
- **PACK 3: Communications** Object \$149  
135 Functions: Smart-modem™, Xon/Xoff, Source \$Call  
Modem-7, X-Modem
- **PACK 4: Building Blocks II** Object \$129  
100 Functions: Dates, Source \$Call  
Text Windows, Data Compression
- **PACK 5: Mathematics I** Object \$99  
35 Functions: Log, Trig, Source \$Call  
Square Root
- **PACK 6: Utilities I** Object \$99  
35 Functions: Archive, DIR Source \$Call  
Manipulation

**NOTE:** Above Packs for Microsoft™ and Lattice™ C Compilers on IBM PC/XT™

To Follow: Graphics, Advanced Math, Other Compilers and Hardware

Prices above for single user, multi user license available

Credit cards accepted (\$7.00 handling/Mass. add 5%)



165 Bedford Street  
Burlington, Mass. 01803  
(617) 273-4711

**NOVUM ORGANUM**

## DOS SHELLS

Function Key	Function
Alt-F1	Displays the help file for the current directory
Alt-F2	Displays the menu for the current directory
Alt-F3	Changes directory to the DOS Shell main menu
Alt-F4	Changes directory to the root directory
Alt-F5	Displays these key assignments
Alt-F6	Displays a map of the subdirectory structure
Alt-F7	Display the directory of drive A
Alt-F8	Display the directory of drive C
Alt-F9	Display the files on drive A by date
Alt-F10	Display the files on drive C by date
Ctrl-F1	Quit (prepare to turn off the system)
Ctrl-F2	Run the PC-DOS CHKDSK program on drive C
Ctrl-F3	Format a floppy disk
Ctrl-F4	Run the PC-DOS CHKDSK program on a floppy disk

**Table 1: Function Key Assignments for DOS Shell**

	DOS Commander	DOS Ease	DOS Shell
<b>Price</b>	\$79.95	\$66.00	\$70.00
<b>Company name and address</b>	Applitek c/o Connecticut Software 30 Wilson Avenue Rowayton, CT 06853	Software Solutions, Inc. 305 Bic Drive Milford, CT 06460	XTC Handcrafted Software P.O. Box 902 Santa Barbara, CA 93102
<b>Memory space used when installed</b>	16624	68624 (Includes second copy of PC-DOS invoked by DOS Ease)	0 Not memory-resident
<b>Brief description</b>	Speeds up PC-DOS but does not make using DOS easier	Well-thought-out compromise between PC-DOS-like operation and ease of use	Helps keep a fixed disk organized but does not make DOS easier to use
<b>Disk space required when installed</b>	0 (Memory resident)	50944	180935

**Table 2: Summary of Features for the Three Shells**

DOS Shell divides the fixed disk into three main areas: the applications program area, the utility area, and the user area. The applications program area is, in turn, divided into business, communications, entertainment, languages, personal, and other subdirectories. Each of these subdirectories has its own file of help information. The authors of DOS Shell intend for each user to install applications programs into the appropriate subdirectory.

The second major division of the fixed disk, the utility area, handles two functions: setting the print mode of an Epson or IBM Matrix

printer and setting up subdirectories for new users of the system.

The primary purpose of DOS Shell is to help organize the fixed disk. This is done by dividing the disk into the three areas mentioned above and by providing separate subdirectories within the user area for each person who uses the computer system. To add a new user area, the DOS Shell user moves to the utilities subdirectory and activates the "Add a new user" function. DOS Shell asks for the name of the new user and creates a new user area accordingly. The next time this user "logs onto" the system, he or



she will have to type "LOGON name." This tells DOS Shell which subdirectories to use for that person's DOS Shell applications programs (again, see figure 1).

In each user area, DOS Shell provides a program to keep track of random notes, a telephone directory, an appointments calendar, and a database program. All except the database program are written entirely using batch files. Unfortunately, all of the programs are awkward to use and not satisfactory. Although DOS Shell shines in organizing the fixed disk, its applications programs leave a great deal to be desired.

For example the "Notes and Memos" subdirectory lists the following functions:

- List notes
- Write notes
- Read notes
- Print notes
- Delete notes
- Go to user menu.

Each of these functions is implemented in a batch file (1.BAT through 6.BAT). When the "Write notes" function is invoked, DOS Shell displays a message describing the procedure for storing a note:

ALL NOTES SHOULD CONTAIN AS THEIR FIRST LINE THE WORD "SUBJECT," FOLLOWED BY A SHORT DESCRIPTION. THIS IS USED BY SELECTION #1, WHEN LISTING NOTES.

COPY CON: TEST.NTS  
SUBJECT this is a test note

F6 <return>.

Clearly, this is not an ideal program; in fact, it is not a program at all. All the other DOS Shell programs included with DOS Shell use similar techniques and are full of nasty quirks and inconveniences. This is largely because the authors of DOS Shell chose to implement all their programs (except the database program, which is written in BASIC

# 2,500 programmers depend on us...

... from giant corporations to small independents. There are many reasons why. First, **THE PROGRAMMER'S SHOP** provides the kind of personal service and support that is not available anywhere else: *answers . . . technical literature . . . newsletters . . . evaluation . . . special disk formats . . . rush delivery . . . and more.* But that's just the beginning. **THE PROGRAMMER'S SHOP** offers *five times* the product selection of any other supplier . . . at good prices. We are committed to helping you write better programs and get maximum productivity out of your software . . . while saving you time, trouble and money. Here are a few examples:

## Intriguing New Products

**The BRIEF™ Editor** for PCDOS is "Out of the way", fast, windows, undo, macros \$195

**LINT-like, SAFE-C** for C86 or Lattice/MS C also has runtime checks, more. "Pioneer". \$400  
**Profiler**, source level in C \$150

**"BASICA compiler"**, also access all RAM, modules, structured. Better BASIC, PCDOS \$195

## For CP/M-80

ECOSoft C is now complete, rich, fast, has library source, trig \$225  
Edit programs with VEDIT (\$119), MINCE (\$149) or "C"SE with source (\$75)

PLINK-86 is a program-independent overlay Linker to 32 levels for all MS Languages, C86 and Lattice. \$315

For a catalog, comparisons, prices, or for an info packet on AI, or Editors, "C," BASIC, PASCAL, FORTRAN, or COBOL—or just for straight answers—

**CALL TOLL FREE 800-421-8006**

## Other Key Products

C86 by CI (\$339), Lattice (\$359) from Lifeboat or Microsoft, and Williams C (\$475) are in a tight battle. Which is best for integration with Fortran? 8087? support libraries? speed? debugging?

**FORTAN-86** from Microsoft (\$259) is improving with libraries for graphics (\$175), screen (\$265). Or consider the DR Fortran special.

**LISP** by Integral Quality (\$155) is well rounded while GC Lisp (\$465) supports syntax closer to "Common LISP." Or Prolog-86 (\$125).

**GraphiC "C"** library with source—for PC, Corona, printers, plotters, Hi-Res, 8087 option, with source \$195

## THE PROGRAMMER'S SHOP™

*The programmer's complete source for software, services and answers*

128-P Rockland Street, Hanover, MA 02339 In Mass.: 800-442-8070 or 617-826-7531

## PROLOG-86™

### Learn Fast, Experiment

1 or 2 pages of PROLOG would require 10 or 15 pages in "C."

Be familiar in **one evening**. In a **few days** enhance artificial intelligence programs included like:

- **an Expert System**
- **Natural Language**

Intro price: \$125 for MSDOS, CPM-86.  
**Full Refund** if not satisfied. Call for details and about our Contest.

## SOLUTION SYSTEMS

335 P-Washington St., Norwell, MA 02061

**617-659-1571**

## C HELPER™

### UNIX-like Utilities for C Programming

**Save time** when working with your C programs. Full source lets you modify, helps you learn.

Utilities included: compare files (DIFF), cross reference variables (CCREF), examine flow of functions (FCHART), search for patterns (GREP). Others check syntax, print your way, more.

\$135 for MSDOS, CPM-86 or CPM80.

## SOLUTION SYSTEMS

335 P-Washington St., Norwell, MA 02061

**617-659-1571**



# DOS SHELLS

but is similarly hard to use) as batch files; PC-DOS 2.0 batch files simply cannot do what is needed to make these programs viable.

The DOS Shell manual is well written and explains the installation and use of DOS Shell in full detail. DOS Shell serves well as a method of organizing a fixed disk, but it fails miserably in its user applications


programs. Nevertheless, it can make using a fixed disk easier, especially in organizations in which more than one person will be using the same computer at different times.

## RECOMMENDATIONS

Table 2 summarizes the characteristics of the three shells reviewed here. DOS Ease, although closer to

PC-DOS than might be desirable, virtually eliminates problems with DOS syntax. The user has only to decide what options to choose; DOS Ease constructs a valid DOS command line from this information. Because DOS Ease is able to do just about anything that PC-DOS can, without complicated syntax, it is an excellent program for anyone who is unfamiliar with PC-DOS. However, DOS Ease, with its forms-filling type of interaction, will slow the more experienced PC-DOS user.

Even closer to PC-DOS is DOS Commander, which does not help with syntax. DOS Commander may make things go faster (even that is questionable), but it certainly does not make using DOS any easier.

Finally, DOS Shell is not a shell at all; it is simply a collection of batch files and one BASIC program. Although DOS Shell does not at all simplify the use of PC-DOS, XT owners might be interested in this program for its ability to organize the fixed disk; they should, however, ignore the applications programs that come with it. 

## Winchester power for your PC



The proven Winchester subsystem drives for your IBM or compatible PC. 10, 15, 25, or 33 megabytes of big system storage in a DiskSystem® you simply plug into your system and it's ready to use. At prices that make the speed and storage of a Winchester practical. Only \$1495 for a 10 megabyte DiskSystem, \$1795 for 15 megabytes, \$2245 for 25 megabytes, or \$2795 for 33 megabytes. DiskSystems can be bootable from the Winchester. See your dealer today for DiskSystem power for your PC.



**Interface Inc.**

21101 Osborne Street  
Canoga Park, CA 91304  
(818) 341-7914 • Telex: 662949

Dealer Inquiries Invited

DiskSystems is a copyright of Interface Inc. IBM is a registered trademark of IBM Corporation. Prices are suggested retail and are subject to change without notice.

### DOS Commander

*Applitek*

*c/o Connecticut Software*

*30 Wilson Avenue*

*Rowayton, CT 06853*

*203-838-1844*

*\$79.95*

CIRCLE 500 ON READER SERVICE CARD

### DOS Ease

*Software Solutions, Inc.*

*305 Bic Drive*

*Milford, CT 06460*

*203-877-9268*

*\$66.00*

CIRCLE 499 ON READER SERVICE CARD

### DOS Shell

*XTC Handcrafted Software*

*P.O. Box 902*

*Santa Barbara, CA 93102*

*805-967-7837*

*\$70.00*

CIRCLE 498 ON READER SERVICE CARD



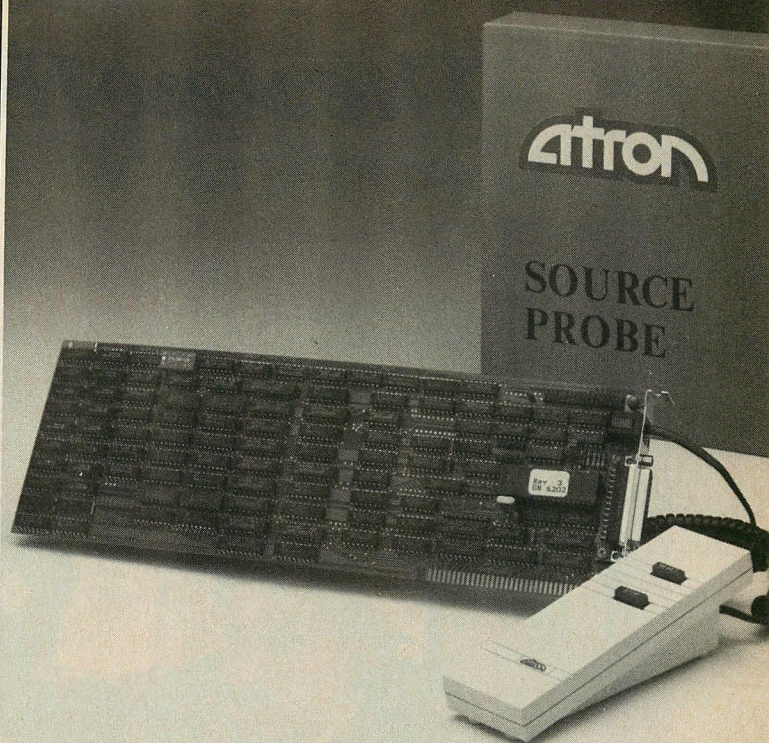
Execution begun.

Breakpoint encountered at 0647:00D7=...FTOCH\_CODE#116  
REAL TIME SOURCE CODE TRACE DATA

LINE NO.	SOURCE or MODULE LINE	NAME
11.	fahr = lower;	
12.	while (fahr <= upper) {	
16.	Compute (fahr, &celsius);	
12.	*c_temp = f_temp - 32;	
13.	*c_temp = *c_temp * 5;	
14.	*c_temp = *c_temp / 9;	

fahr= 0  
celsius= -17  
upper= 100  
temp= 10

Assign BP Byte Compare CONsole DElete Dlr DMA Echo Edit EMacro Eval Fill  
Lag Go IF INIt INterrupt List LOAd LOGic LOOP Macro MEnu MODule MORE  
Atron's Source Code Debugger Version X010 (C)Copyright Atron Corp. 1984



# ATRON Announces A State of the Art Advance in Source Level Software Debugging

## PROGRAMMERS AND MANAGERS

know that finding bugs during new product development and over the entire product life cycle adds up to a significant portion of total product development cost and support time. Investing in the right debugging tools will greatly improve time to market as well as minimize development cost. Atron Corp. has the right debugging tools for the PC environment. These are:

- 1) PC PROBE
- 2) SOURCE PROBE
- 3) PERFORMANCE ANALYZER

These tools run on a PC or compatible.

### A Snapshot of Real Time Program Execution

Program flow is saved in trace memory while running at full speed. PC PROBE can display trace data as high level language source code or as 8088 instructions. Real time trace answers the question "How did I get here"?

### A Bullet of Proof Debugger

What good is a debugger that can be wiped out by an undebugged program? PROBE software is write protected and can't be changed.

## Trap Memory Overwrites

The PC PROBE has 8 breakpoints and can trap conditions such as instruction execution, read, write, IO, DMA, interrupt, or external logic probes. Breakpoints can also be set on ranges of address or data — symbolically too!

## Don't Look in the Manual

The PC PROBE designers know the importance of EASE OF USE. The PC PROBE interface has a menu window which displays the syntax of each command — so you never have to remember how a command works. It also recalls the previous invocation of each command to save tedious typing — and tedious thinking!

## Symbolic Debugging

Avoid the tedium of sifting through link maps to find out where things are. The PC PROBE uses your C, PASCAL, or assembly language program symbols.

## Macro Commands

Why be limited by a fixed set of debugging commands? PC PROBE lets you create your own powerful macro commands with parameter passing, nesting, LOOPING and IF/THEN/ELSE control.

## ANNOUNCING SOURCE PROBE

Why waste time with a debugger which shows your C or PASCAL programs in 8088 assembly language. Atron's new SOURCE PROBE let's you step, real time trace, and edit your Hi Level source code during debug. Display data structures in the format which your program uses.

## PERFORMANCE ANALYZER

How do you find time critical program problems or know where to start performance tuning your software? Get Atron's new Software Performance and Timing Analyzer. Then you can display histograms of how your programs run — by time or by events. You can perform many different timing measurements.

Atron has many happy customers who have made critical product schedules because of PC PROBE. Why waste time on primitive debugging techniques? — Call us today and ask for your 12-page data sheet.



20665 FOURTH STREET • SARATOGA, CA 95070 • (408) 741-5900

CIRCLE NO. 107 ON READER SERVICE CARD



# *The new IBM DisplayWrite*



Little Tramp character licensed by Bubbles Inc., s.a.

\*Prices apply at IBM Product Centers and may vary at other stores.

\*\* Available in July, 1984.



# *Series is here. Spread the word.*

In 1980, IBM introduced the Displaywriter System. Today, it's become the best-selling stand-alone text processor in the world. One reason for this success is the Displaywriter's function-rich software.

If you're looking for software like that, but working on an IBM personal computer, you don't have to look any further. Because the IBM DisplayWrite Series is here.

And it will put many of the features and capabilities of a dedicated word processor to work for you when you're writing.

## *It runs in the family.*

You'll find two word processing programs in this series: There's DisplayWrite 1, for IBM personal computers — including PCjr. And DisplayWrite 2, with added functions for your PC, PC/XT or *Portable* PC.

You'll also find DisplayWrite Legal, a dictionary of about 16,000 words that a lawyer might need to check.

And you'll find DisplayComm, which lets your IBM PC send and receive text to and from other IBM PCs. If you're writing at the office, this program could also let you send text to an IBM Displaywriter down the hall. (From there, it could be sent on to an IBM host computer for distribution.)

## *Some words on high function.*

The DisplayWrite word processing programs give you the time-saving features you'd expect from IBM. Justified margins, centered lines and pagination, for example. You'll even have prompts and messages to help guide you along.

But there are also some features in DisplayWrite 2 you might not expect. Like easy column formatting, four-function math capability *plus* a spelling checker based on a dictionary of about 100,000 words.

Yet the biggest surprise of all may be the price.\* DisplayWrite 1,\*\* \$95. DisplayWrite 2, \$299. DisplayWrite Legal, \$165. DisplayComm, \$375.

## *Where you can find all four.*

Get more information about the IBM DisplayWrite Series at your authorized IBM Personal Computer dealer or IBM Product Center. To find one near you, call 800-447-4700. In Alaska or Hawaii, 800-447-0890.

Stop there first and get the last word.



*Personal Computer Software*

CIRCLE NO. 152 ON READER SERVICE CARD



# Enhancements

## SOFTWARE

<b>Aptec</b> (for color Prism Printers)	
Rainbow Writer Color Text Formatter ..	\$119.
Rainbow Writer Screen Grabber .....	69.
<b>Ashton Tate</b>	
dBase II .....	279.
dBase III .....	375.
Upgrade (dBase II to dBase III) .....	139.
Framework .....	375.
Friday! .....	169.
Reference Encyclopedia (book) .....	55.
<b>Best Programs</b>	
Personal Finance Programs .....	65.
PC/Professional Finance Program II ..	149.
PC/Fixed Asset System .....	297.
PC/Tax Cut .....	149.
<b>Bible Research</b>	
THE WORD (KJV Bible - 7 disks) .....	145.
<b>Bruce &amp; James</b>	
WordVision .....	39.
<b>Digital Research</b>	
CP/M-86 .....	39.
Dr. LOGO (requires 192k & RGB monitor)	69.
<b>Financier</b>	
Financier II .....	115.
Financier Tax Series .....	97.
<b>Funk Software</b>	
Sideways .....	45.
<b>Lifetree</b>	
Volkswriter .....	115.
Volkswriter International .....	135.
Volkswriter Deluxe (with TextMerge) ..	165.
<b>Lotus Development</b>	
1-2-3 (version 1A) .....	call
Symphony .....	call
<b>Micropro</b>	
WordStar & Propak come with quick lesson	
CAI training disk and tutorial disk	
WordStar 3.3 .....	219.
Propak (WordStar/MailMerge/	
CorrectStar/StarIndex) .....	279.
<b>Microrim</b>	
R:base 4000 .....	279.
Extended Report Writer .....	85.
Clout .....	119.
<b>Microsoft</b>	
Multiplan (ver 1.2) .....	139.
Financial Statement (for Multiplan) ..	69.
Budget Analysis (for Multiplan) .....	99.
Microsoft Word (ver 1.1) .....	239.
Microsoft Word with mouse (ver 1.1) ..	289.
<b>Microstuf</b>	
Crosstalk XVI .....	99.
Infoscope .....	149.
Transporter (includes Crosstalk) .....	169.
<b>PCsoftware</b>	
PCcrayon II (new release) .....	39.
Executive Picture Show .....	139.
CREATABASE .....	47.
<b>Peachtree</b>	
PeachPak Series 4 (G/L, A/R, A/P)	
new version, IBM manuals .....	195.
<b>Peter Norton</b>	
Norton Utilities .....	55.
<b>Rosesoft</b>	
Prokey 3.0 .....	89.
<b>Satellite Software</b>	
WordPerfect .....	call

## PC Connection Software Special

through October 31, 1984

### Software Publishing

#### PFS/Access

#### The first of a series of PFS

#### telecommunications products.

Works with the following modems:

- Hayes Smartmodem 300, 1200, 1200B
- Novation 103 and 103/212 Smart-Cat
- Transend PC Modem Card
- US Robotics Password
- Ven-Tel PC Modem Plus & others
- Included with the package are offers valued at over \$200 from The Source, Dow Jones, Western Union Easylink, MCI Mail, Compuserve & Micro Communications Magazine ..... \$59.

### Software Publishing

PFS/Access .....	see special
PFS/File .....	\$89.
PFS/Graph .....	89.
PFS/Write .....	89.
PFS/Report .....	79.

### Softword Systems

MultiMate (ver 3.22 w/spell checker	
& tutorial) .....	call

### Sorcim

Supercalc 3 .....	199.
-------------------	------

### Virtual Combinatics

Micro Cookbook .....	29.
----------------------	-----

### Warner Software

The Desk Organizer w/1 yr. free	
updates .....	197.

## TRAINING

### ATI

How to use Lotus 1-2-3 (volume 1 & 2) ..	49.
How to use Wordstar (volume 1 & 2) ..	49.
How to use dBase II (volume 1 & 2) ..	49.
How to use EasyWriter II .....	49.
How to use Multiplan .....	49.
How to use Your IBM-PC .....	32.
How to use MultiMate (volume 1 & 2) ..	49.
How to use Microsoft Word .....	49.
How to use PC DOS .....	32.
How to use TK!Solver .....	49.

### Individual Software

The Instructor .....	35.
Professor DOS .....	47.
Tutorial Set (both items above) .....	75.
Professor Pixel .....	47.
Typing Instructor .....	39.

### Scarborough Systems (was Lightning)

Master Type .....	39.
-------------------	-----

## EDUCATIONAL

### Davidson

Speed Reader II (high school & college)	49.
Math Blaster (grades 1-6) .....	35.
Word Attack (grades 4-12) .....	35.

### Friendly Soft

FriendlyWare/PC Introductory Set .....	35.
--	-----

### Stone (requires graphics board)

Great graphics and sound	
My Letters, Numbers, Words (ages 1 to 5)	29.

Kids Stuff (ages 3 to 8) .....	\$29.
Across the U.S.A. (ages 5 & up) .....	22.

## GAMES

### Atarisoft

Centipede .....	29.
Pac Man .....	29.
Dig Dug .....	29.
Defender .....	29.
Donkey Kong .....	29.
Stargate .....	29.
Robotron .....	29.

### Broderbund

Apple Panic .....	23.
Lode Runner .....	25.

### Funtastic

Snack Attack II (a favorite) .....	27.
Cosmic Crusader (as good as above) ..	27.
Big Top (climb to new levels) .....	29.
Master Miner (1 or 2 players) .....	29.

### Hayden Software

Sargon III .....	35.
------------------	-----

### Microsoft

Flight Simulator (new version) .....	35.
--------------------------------------	-----

### Orion

J-Bird (you'll never sleep) .....	29.
PC-Man .....	25.
Paratrooper .....	25.
Pits & Stones .....	29.

### PCsoftware

Championship Blackjack .....	23.
------------------------------	-----

### Sir-Tech

Wizardry .....	42.
----------------	-----

### Sublogic

Night Mission Pinball .....	29.
-----------------------------	-----

## HARDWARE

### AST Research (For IBM-PC or XT)

All AST Boards come with SuperDrive,	
SuperSpool, and one year warranty.	
SixPakPlus 64k upgradeable to 384k, with	
clock calendar, serial and parallel ports	
(game port optional) .....	269.
MegaPlus II 64k upgradeable to 256k (or	
more with MegaPak) with clock calendar	
and serial port (parallel, game, or second	
serial port optional) .....	269.
MegaPak 128k (not upgradeable) .....	call
MegaPak 256k .....	call
I/O Plus II with clock calendar and serial	
port (parallel, game, or second serial	
port optional) .....	129.
Parallel Game or second Serial Port	
(for any AST board (specify board) .....	39.
Connectall connector bracket (PC only) ..	19.
AST-5251 .....	559.
AST-3/80 .....	649.
MonographPlus with clock calendar,	
serial & parallel ports .....	429.

### Amdek

Video 300G monitor (green) .....	149.
Video 300A monitor (amber) .....	159.
Video 310A monitor (amber) .....	179.

### Compucable

Plastic Keyboard & Drive Cover Set .....	17.
IBM Mono Screen Enhancement .....	17.
Printer to IBM Cable (specify printer) ..	32.
Smartmodem to IBM Cable .....	25.



# for advancements.

## Curtis

**STANDS**  
PC Pedestal (for IBM Mono or Color)... \$39.  
PGS or Quadchrome Adapter for above... 9.  
Low Profile Tilt and Swivel Pedestal... 39.  
System Stand... 21.

## CABLES

Extension Cables for IBM Mono Display 39.  
Keyboard Extension Cable (3 to 9 feet) 29.  
AC Plug Adapter (any monitor to your PC) 8.

## SURGE SUPPRESSORS - NEW

See special

## Epson

RX-80 with GRAFTRAX-Plus... call  
RX-80 F/T with GRAFTRAX-Plus... call  
FX-80 with GRAFTRAX-Plus... call  
RX-100 with GRAFTRAX-Plus... call  
FX-100 with GRAFTRAX-Plus... call  
LQ-1500 (letter quality dot matrix)... call  
Printer to IBM Cable (specify printer)... 32.

## Hayes

Smartmodem 300... 209.  
Smartmodem 1200... 489.  
Smartmodem 1200B (w/Smartcom II) 409.  
Smartcom II... 99.  
Compucable's Smartmodem-to-IBM  
Cable... 25.

## Hercules Computer

Hercules Graphics Card (parallel port) 339.  
Hercules Color Card (parallel port)... 179.  
Graph-X Software... 42.

## key tronic

Typewriter style keyboard (KB 5150)... call  
Deluxe keyboard (KB 5151)... call

## Koala

Koala Touch Tablet with software  
(connects to game port)... 89.

## Kraft

Joystick... 39.

## Maynard Electronics

Floppy Drive Controller... 135.  
Internal Hard Disk (10 Meg), WS-1 Controller  
& ROM for PC mother board... 879.  
Internal Hard Disk (10 Meg) WS-2 Controller  
& ROM for PC Mother Board... 1079.

## Mouse Systems

PC Mouse (w/software & desk pad)... 189.

## NEC

Spinwriter 3550 (IBM-PC compatible) 1625.  
Spinwriter 2050 (3550's little brother)... 869.

## Orchid Technologies

All Orchid Boards come with PCnet Drive  
(Ram disk). PCnet spool (print spooling),  
disk caching & partitioning.

Blossom 64k upgradeable to 384k, with  
clock calendar, serial and parallel ports 259.

PCnet Daughter Board (piggybacks to  
Blossom) with version 2.4 networking  
software... call

## Paradise Systems

MultiDisplay Card (color & mono)... 289.

## Plantronics/Frederick

COLORPLUS (w/Color Magic)... call

## PC Connection Hardware Special

through October 31, 1984

### CURTIS

#### Surge Protectors

Curtis Manufacturing has designed a  
new line of surge protectors to be com-  
petitive with the EPD Lemon, Lime,  
Orange and Peach. The Curtis pro-  
tectors exceed EPD's specs and are  
covered by a lifetime warranty against  
defects.

- Diamond (similar to EPD Lemon) \$35.
- Emerald (similar to EPD Lime) \$45.
- Sapphire (similar to EPD Peach) \$55.
- Ruby (similar to EPD Orange) \$65.

## WHEN YOU CALL PC CONNECTION

In order to process your order quickly and  
efficiently, we need to feed our new main-  
frame computer a few tidbits of information.  
Bill to. Ship to. Method of payment. Method  
of shipment. And, of course, what you'd like  
to order.

We'd also like to know where you saw our ad  
and, if possible, we'd like you to read us the  
small code number that appears next to our  
phone number.

If you have all of this information ready when  
you call, we'll have you back to work and  
your products on the way that much quicker.

## OUR POLICY

- We accept VISA and MASTERCARD.
- No surcharge added for charge cards
- Your card is not charged until we ship.
- No sales tax.
- All shipments insured; no additional charge.
- Allow 1 wk. for personal & co. checks to clear.
- COD max. \$500. Cash or certified check.
- 120 day guarantee on all products.\*
- To order, call us anytime Monday thru Friday  
9:00 to 9:00, or Saturday 9:00 to 5:30.

## SHIPPING

**Continental US:** For monitors, printers, and  
drives, add 2% to all orders. For all other  
items, add \$2 per order for UPS surface, \$3  
per order for UPS 2nd-Day-Air. We particu-  
larly recommend 2nd-Day-Air if you live west  
of the Mississippi or south of Virginia. In most  
cases it will only cost \$1 more and will save  
you up to four days on delivery time. **Outside  
Continental US:** We add freight charges to  
credit card purchases. For prepayment, call  
603/446-3383 for information.

# 1-800/243-8088

PC Connection

295T

6 Mill St., Marlow, NH 03456

603/446-3383

For the IBM-PC Exclusively.

## Princeton Graphics

HX-12 RGB monitor (690 x 240)... call  
SR-12 RGB monitor (690 x 480)... call  
Scan Doubler Board (for SR-12)... call  
MAX-12 Amber monochrome monitor... call

## Quadram

**We are a full line Quadram Dealer**

New Expanded Quadboard 64k  
expandable to 384k, with clock calendar,  
parallel, serial & game port, I/O bracket,  
and Quadmaster software... \$269.  
Microfazer Printer Buffer (parallel) w/copy  
MP 64 (64k) upgradeable to 512k... 197.  
Quadcolor I... 197.  
Quadchrome RGB Monitor... 489.  
Quadlink (allows you to run most Apple II  
programs directly on your IBM-PC or XT) 459.

## SMA (Systems Management)

PC-Documate Keyboard Templates

available for:

DOS/Basic 1.1	Multimate
DOS/Basic 2.0	Multipan (IBM)
Lotus 1-2-3	Multipan (Microsoft)
dBase II	Peachtext 5000
Easywriter II	Volkswriter
Wordstar	(each) 12.

## TG

Joystick... 45.

## USI (monitors for graphic board)

Pi-2 Monitor (12" green, with cable)... 119.  
Pi-3 Monitor (12" green, with cable)... 129.

## DRIVES

All drives are completely pre-tested. Specify  
Drive A or Drive B for your PC. Comes with  
complete step by step installation instructions.  
Drives are 320k/360k.

## Tandon

TM 100-2 (5 1/4") full-height drive (DS,DD) 199.

## TEAC

FD-55B (5 1/4") half-height drive (DS,DD) 169.  
Free 'y' cable & bracket with each pair.

## MEMORY

64k Memory Upgrade Set for IBM-PC  
or XT system board... 59.  
64k Memory Upgrade Set for any memory  
board specify make of board... 59.  
Install memory upgrades & run diagnostics  
at time of board purchase only... 10.

## DISKS

**Verbatim** (with 5 year guarantee)  
Datalife Disks SS/DD plastic box of 10 23.  
Datalife Disks DS/DD plastic box of 10 33.  
Disk Drive Analyzer... 22.  
Flip Sort (holds 75 disks) 19.

## INFORMATION SERVICES

### Compuserve

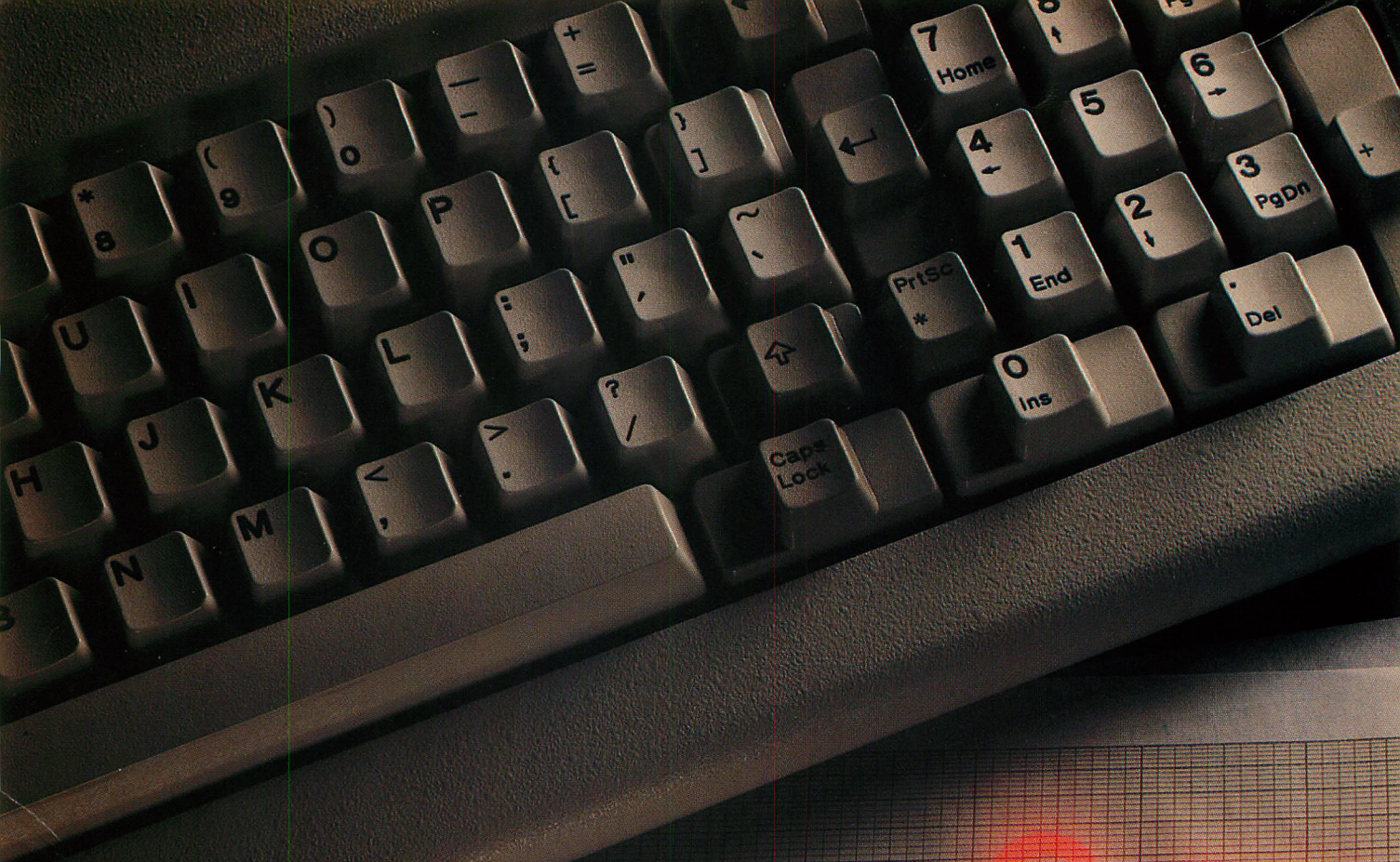
Compuserve Information Service  
(includes subscription, manual, 5 hours of  
connect time, monthly publications)... 29.

### Source Telecomputing

The Source (subscription & manual)... 49.

# PC CONNECTION®





$1.0E-8$

$1.0E+08$

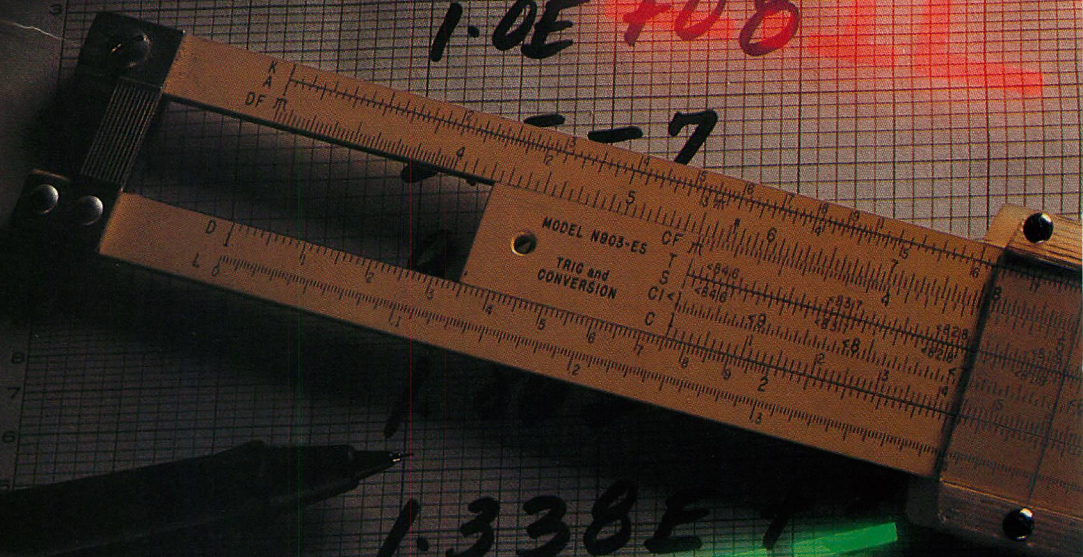
$-7$

$1.338E7$

$1.000E-50$

$9.999E+49$

$1.862E5$



DIETZEN CORPORATION  
MADE IN U.S.A.

DIETZEN CORPORATION  
MADE IN U.S.A.

DIETZEN GRAPH PAPER  
GRAPHIC DIVISIONS PER INCH



# Significant Figures, I

## *Floating-point addition and subtraction on the IBM PC*

ROBERT GRAY

Because the Intel 8088 (the processor that does the computational work for the IBM PC) is a 16-bit integer processor, it cannot represent fractions or work with numbers larger than 65,535, the largest number representable in 16 bits. The ability to store and add fractions and very large numbers requires complex machine-language programs called floating-point routines. It is these routines that make arithmetic so simple in BASIC and virtually all other high-level languages.

As assembly language programmers know, the lack of floating-point routines enormously complicates the job of developing machine-language programs. Yet surprisingly few programmers have any notion of how floating-point routines work or more than the vaguest notion of what they do. Without special training, assembly

---

*This is the first of three articles by Robert Gray on the subject of floating-point arithmetic on the IBM PC. Part two will discuss methods of using floating-point numbers to do multiplication and division; part three will cover binary-to-decimal floating-point conversion. Gray is an assistant professor of information systems at Virginia Commonwealth University.*



language programmers who try to write their own routines for floating-point arithmetic face problems.

Reading the many published descriptions of floating-point representation will probably not help, because floating-point routines are very difficult to code and notoriously hard to debug. Understanding the procedures required for doing floating-point arithmetic is essential; published algorithms are as obscure as they are rare, however.

This article is intended to provide assembly language programmers with all that they need to know to do floating-point arithmetic on the IBM PC and any other microcomputer that uses the 8088 or 8086 microprocessor. It describes floating-point numbers and representation and gives an algorithm for doing the most difficult floating-point operations—which are, surprisingly, simple addition and subtraction. For those assembly language programmers who cannot or will not take the time to write their own routine, the article includes a tested and thoroughly documented assembly language routine for addition and subtraction.

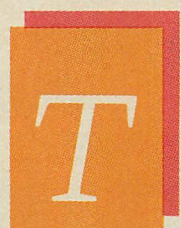
## FLOATING-POINT NOTATION

BASIC prints numbers in essentially two ways. For example, the number one million would be printed as 1000000; one millionth, as .000001. Such numbers are clear; they are what most of us think numbers should look like. There are other ways of representing numbers, however, and the interpreter sometimes uses them. For example, the number one hundred million would be printed as 1.0E+08; one hundred millionth, on the other hand, would be printed as 1.0E-08. This may require some explanation.

A number in floating-point notation has two parts: the *mantissa*, or *fraction*, to the left of the *E* and a signed *exponent* to the right. Converting a number in this form to ordinary positional notation is simple.

Just multiply the mantissa by 10 raised to the power given as the exponent. For example, 1.86282E5 is equivalent to  $1.86282 \times 10^5$ , or 186,282—the approximate speed of light in miles per second. The number 2.1E-7 would be equivalent to  $2.1 \times 10^{-7}$ . Because  $10_{-7}$  is equal to  $1/10^7$  or to 0.0000001, the number is 0.000000210—the approximate length in seconds of a single clock cycle on the IBM PC.

Actually there is a simpler way. Multiplying any decimal number by 10 is equivalent to shifting the number left one place or to shifting the decimal point to the right one



*he convention that the decimal should follow the first non-zero digit is arbitrary. It could just as easily have been decided that, in a normalized floating-point number, the decimal point should be placed before the first significant digit.*

place; multiplying by a positive power of 10, say  $10^3$ , amounts to no more than shifting the decimal to the right three times. Multiplying by a negative power of 10 is just the reverse; the decimal is shifted to the left. In either case, the extra spaces, if any, are filled with zeros. See figure 1 for an illustration of this process.

Converting from floating-point to fixed-point notation is not difficult, but what about converting in the other direction? How, for example, would the decimal number 10 be represented as a floating-point number? It could be written equally well as .10E+2 or as 100.0E-1. Theoretically, at least, there is an infinite number of ways in which 10 could be expressed in floating-point notation, depending on where the decimal is placed.

For consistency, then, floating-point numbers are expressed in a conventional form. The decimal point follows the first significant digit. Thus, the decimal number 10 would normally be written as 1.0E+1, and numbers that are expressed according to this rule are said to be *normalized*.

Once a convention governing where the decimal point should go has been established, it is possible to convert from fixed- to floating-point notation with the following steps (see also figure 2):

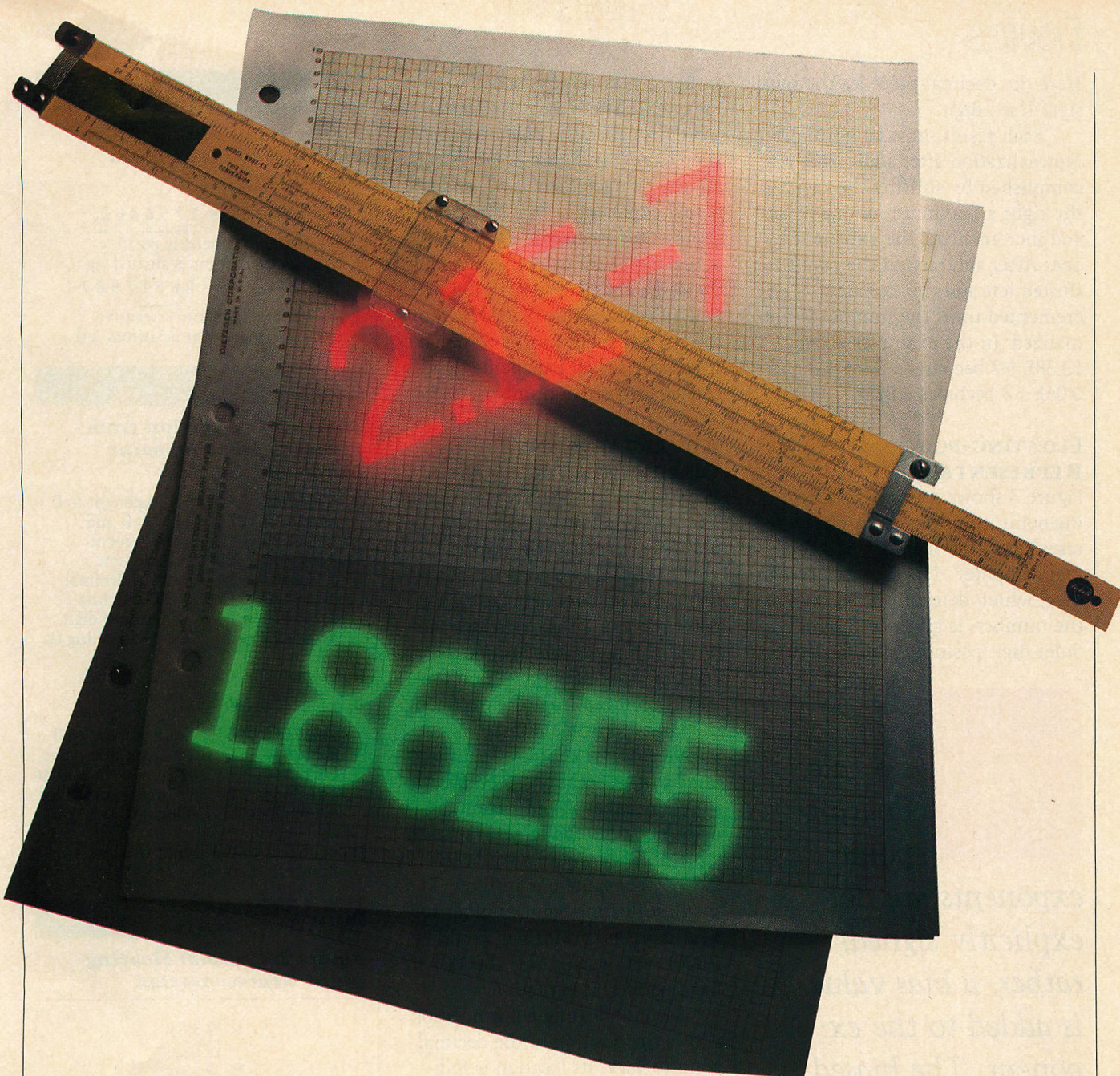
1. Set the exponent to zero.
2. If the decimal point is to the right of the first non-zero digit, shift the decimal to the left, incrementing the exponent, until the decimal point follows the first significant digit.
3. If the decimal point is to the left of the first non-zero digit, shift the decimal to the right, decrementing the exponent, until the decimal point follows the first significant digit.
4. Discard any leading or trailing zeros.

The convention that the decimal should follow the first non-zero digit is arbitrary. It could just as easily have been decided that, in a normalized floating-point number, the decimal point should precede the first significant digit.

## FLOATING-POINT ADDITION

Floating-point notation presents some problems for arithmetic. It is not possible to add the following:





$$9.9\text{E}-3 = 0.0099$$

$$+9.7\text{E}+2 = 970.0$$

because the decimal points are in different places. To add any two floating-point numbers, the two decimal points must first be aligned.

This can be done by denormalizing the number with the smaller exponent, shifting it to the right, and incrementing its exponent a sufficient number of times to make the exponents equal. Note that shifting the mantissa right is equivalent to dividing it by 10, so that incrementing the exponent does not

change the expression's value. In the example above, the smaller exponent is  $-3$ , the larger is  $2$ , and the difference is  $5$ . Moving the decimal point five places to the left in the smaller number gives

$$\begin{array}{rcl} 0.000099\text{E}+2 & = & 0.0099 \\ +9.7\text{E}+2 & = & 970.0 \\ \hline 9.700099\text{E}+2 & = & 970.0099 \end{array}$$

#### **NORMALIZATION**

Ordinarily, the exponent of the result is the exponent of the original larger number, but because floating-point numbers are normalized, this will not always be the case. It is pos-

sible for the addition of two floating-point numbers to yield an unnormalized result. For example,

$$\begin{array}{r} 5.79\text{E}+2 \\ + 7.59\text{E}+2 \\ \hline = 13.38\text{E}+2 \end{array}$$

The result is not considered normalized, because the decimal point does not follow the most significant digit.

Subtraction can also yield an unnormalized result. For example,

$$\begin{array}{r} 1.50\text{E}+3 \\ -1.44\text{E}+3 \\ \hline = 0.06\text{E}+3 \end{array}$$



## FIGURES

Here the decimal precedes the most significant digit.

Each result must be normalized. Normalization after addition is accomplished by shifting the carry to the right a maximum of one place and incrementing the exponent by one. After subtraction the result is shifted left and the exponent is decremented until the number is normalized. In the examples above,  $13.38E+2$  becomes  $1.338E+3$  and  $0.06E+3$  becomes  $6.0E+1$ .

### FLOATING-POINT REPRESENTATION

Figure 3 shows a seven-digit floating-point number as it might be represented in the memory of a decimal computer. The sign of the mantissa, which determines the sign of the number, is given in the high-order digit position. The next two

**A**s a rule, floating-point exponents are not explicitly signed; rather, a bias value is added to the exponent. The biased exponent, which is called the characteristic, is then stored.

digits represent the exponent. The lower four digits are reserved for the mantissa. In normalization the decimal point need not be stored; it may be assumed that it follows the first significant digit.

The exponent's sign is not shown. As a rule, floating-point exponents are not explicitly signed;

rather, a bias value is added to the exponent. The biased exponent, which is called the *characteristic*, is then stored. In figure 3, the bias is 50, the characteristic is 52, and the actual exponent is +2. The number represented, therefore, is 317.8. An actual exponent of -2 would have yielded a characteristic of 48 ( $50-2$ ) and an actual value of .03178. Storing the exponent in this way makes it possible for all exponents to be treated as positive numbers.

### ADVANTAGES AND DISADVANTAGES

Why is floating-point representation used? After all, it seems to be a complicated way to store numbers.

There are two good reasons for using this notation. First, floating-point representation increases the range of representable numbers. Look again at figure 3. When the bias is removed from the exponent, the largest possible number is  $9.999E+49$ . By contrast, had the same storage locations been used to store a number in ordinary fixed-point notation, the largest representable number would have been only 999999, not quite one million. The smallest floating-point number representable in this format would be  $1.000E-50$ , versus only .000001 in fixed-point representation.

Second, floating-point notation allows the position of the decimal point to vary. Its location is indicated by the exponent. Suppose we used a fixed-point scheme that stored the whole part of a number in the upper three digits and the fraction in the lower three. The largest representable number would be 999.999, but we could not store 99.9999, although it is smaller and contains the same number of digits.

Floating-point representation has its disadvantages, however. Although this method does increase the range of representable numbers, it places certain constraints on their accuracy. Most single-precision floating-point routines provide six or

### Figure 1: Conversion from Floating- to Fixed-point Notation

$$1.7564E6 = 1\ 7\ 5\ 6\ 4\ 0\ 0$$

If the exponent is positive, the decimal point is shifted right

$$1.7564E-3 = 0.0017564$$

If the exponent is negative, the decimal point is shifted left

### Figure 2: Conversion from Fixed- to Floating-point Notation

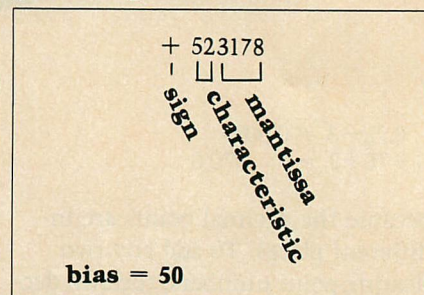
1756400.	E0	Set exponent to 0
175640.0	E1	Shift left and
17564.00	E2	increment
1756.400	E3	exponent
175.6400	E4	until decimal
17.56400	E5	follows first
1.756400	E6	non-zero digit
1.7564E6		Discard trailing 0s

If decimal is to the right of the first non-zero digit, shift it left

.0017564	E0	Set exponent to 0
0.017564	E-1	Shift right and dec-
00.17564	E-2	rement exponent
001.7564	E-3	until normalized
1.7564E-3		Discard leading 0

If decimal is to the left of the first non-zero digit, shift it right

### Figure 3: Decimal Floating-point Representation



seven digits of accuracy, meaning that only the first six or seven digits of any number are actually stored (the format shown in figure 3 stores only four digits). A number such as  $1.245E+8$  could thus be in error by as much as 49,999. So far as the floating-point routines are concerned, the numbers 124,549,999 and 124,450,001 are equal.



**Figure 4: Binary Floating-point Formats (for +13.5)**

sign 1 bit	exponent 8 bits	mantissa 23 bits	exponent bias = 127
0	10000010	1011000 00000000 00000000	

8087 floating-point format

exponent 8 bits	sign 1 bit	mantissa 23 bits	exponent bias = 128
10000100	0	1011000 00000000 00000000	

IBM PC BASIC (8088) floating-point format

(+13.5) is shown in each case. Each format uses 32 bits. Although only 23 bits are shown, each format actually uses a 24-bit mantissa.

Floating-point numbers are stored in a normalized form so that the most significant digit is not zero. In binary, this necessarily means that the leading digit is a 1. Since the value of this digit is known, there is no need to waste space by storing it. The space saved is used to store the sign.

The two formats shown in figure 4 differ in some respects. On the 8087, the binary point is assumed to follow most significant digit, whereas on the 8088 the binary point is assumed to precede the leading digit. Thus, in the 8087 format, the mantissa is always greater than or equal to 1 and less than 2. In the BASIC format, the mantissa is always less than 1 and greater than or equal to .5 (0.1 in binary). If the leading ones are restored, the mantissas shown in figure 5 could be written as 1.1011 and 0.11011.

The two formats also use different exponent biases. In PC BASIC, the bias is 128, so the largest possible exponent is 127. Since the largest number representable in 8 bits is 255, a larger exponent would cause *overflow*, meaning that the number exceeds its allowable range. Similarly, the largest negative exponent is -128. A lesser exponent would produce a characteristic less than zero, causing *underflow*.

The 8087 uses a bias of 127. It would be logical to expect this to yield a maximum positive exponent of 128 and a maximum negative exponent of -127; however, the 8087 reserves the values 0 and 255, so the permissible exponent range is actually -126 to 127.

To convert the numbers shown in figure 4 to their decimal equivalents, subtract the exponent bias, move the binary point the appropriate number of places to the right of its implied position, and convert the resulting binary number to deci-

**Figure 5: Alignment and Rounding**

operand1	10110001	00000011	00101000	exponent = 134
operand2	10001011	10000010	00001101	

operand1	10110001	00000011	00101000	
operand2	00010001	01110000	01000001	

guard bit ↗

Alignment without sticky bit  
After alignment, the mantissa may be up to 48 bits long.

operand1	10110001	00000011	00101000	
operand2	00010001	01110000	01000001	

guard bit ↗ ↖ sticky bit

Alignment with sticky bit  
Only the guard bit is kept. A sticky bit indicates whether any ones were lost.

sum	11000010	01110011	01101001	1	1	exponent = 134
round					1	
result	11000010	01110011	01101010			

Round sum by adding one to guard bit.

This kind of inaccuracy is just the sort of problem that makes accountants have nightmares. Obviously, it is important that programmers take these limitations into account when they are developing procedures that utilize floating-point arithmetic, especially if it is possible that the error might be cumulative.

## BINARY FLOATING-POINT REPRESENTATION

Several different floating-point formats are used on contemporary computers. Figure 4 shows two commonly used single-precision formats. The top one is the format used in the 8087 floating-point coprocessor. The other is the format used by IBM PC BASIC. The same number



## FIGURES

mal. Bear in mind that places to the right of the binary point express negative powers of 2; that is, 0.1 is equivalent to .5 decimal and 0.01 is equivalent to .25 decimal, and the binary fraction 0.01011 would be  $11/32$  ( $1/4 + 1/16 + 1/32$ ).

### ROUNDING

As noted above, floating-point addition requires that the operands be aligned by shifting the smaller operand to the right until the exponents are equal. This requirement creates a problem. Figure 5 shows two floating-point mantissas. The difference in the exponents is 3, meaning that the smaller operand is to be shifted right three bits. This will put 0s in the upper three bits, but what becomes of the lower three bits? It is tempting just to drop them, since

**A**ddition is probably the most difficult of floating-point operations, and coding a floating-point addition routine on the 8088 is quite a challenge. The basic algorithm is, however, fairly straightforward.

they cannot add directly to the 24-bit mantissa of the result.

There are two schools of thought here. According to one school, all right-shifted digits should be kept to ensure the accuracy of intermediate results. This method would require that 48 bits be set

```

1. Let E1, E2, S1, S2, M1, and M2 be the exponents, signs, and
   mantissas of the two operands.

2. Restore leading 1s

3. IF operand1 < operand2 THEN exchange E1,E2; M1,M2; S1,S2
   {ensure that larger number is in operand1}
   ELSE
     IF operand1=operand2 and S1<>S2 THEN RESULT=0: GOTO EXIT
     {If the signs are opposite, operand2 is to be
      {subtracted from operand1. This would yield
      {0 for equal operands (E1=E2 and M1=M2)}.

4. COUNT=E1-E2 {COUNT is the difference between the exponents}

5. IF COUNT > 24 THEN RESULT=operand1: GOTO EXIT
   {Shifting the smaller operand more than 24 bits
   {to the right makes its mantissa equal to 0}
   ELSE
     shift M2 right COUNT bits
     {The operands are aligned by shifting the smaller
     {right a sufficient number of places to make
     {the exponents equal. At this point, two guard
     {bits (the last two bits shifted) are needed. Other
     {right-shifted bits are ORed into the sticky
     {bit.

6. IF S1=S2 THEN
   M1=M1+M2
   {If signs are equal, add the two operands.
   IF M1 > .5 THEN shift M1 right 1 bit: E1=E1+1
   {Addition may produce a carry to the left of
   {the binary point, so NORMALIZE
   ELSE
     M1=M1-M2
     {Opposite signs, so subtract operand2
     WHILE M1 < .5 shift M1 left 1: E1=E1-1 WEND
     {NORMALIZE M1 by shifting left, decrementing
     {the exponent, until the leading bit is a one

7. IF guard bit=1 AND (sticky bit is on OR M1 is odd) THEN M1=M1+1
   {Round to even

8. IF M1 > 1 THEN shift M1 right 1 bit: E1=E1+1
   {Normalize again if upward rounding produced
   {a carry to the left of the binary point

9. Set RESULT to E1, S1, M1

10. EXIT
  
```

**Figure 6: An Algorithm (in Pseudo-code) for Floating-point Addition**

aside for the mantissa of the smaller operand, because it might be shifted to the right as much as 24 bits. If alignment requires shifting more than 24 bits, the smaller operand would effectively become 0, since it could not affect the final sum. The other school of thought says it is sufficient to keep just enough information about the right-shifted bits to provide for accurate rounding.

Figure 5 illustrates this rounding technique. Here the mantissa of

the right-shifted operand has been expanded to 26 bits. The leftmost extra bit is called a guard bit; it holds the last bit shifted out of the original mantissa. The other extra bit, called a sticky bit, serves a slightly different purpose. The sticky bit is on if any 1s have been shifted past the guard bit. When the mantissa is right-shifted, the guard bit is ORed into the sticky bit; the least-significant digit in the mantissa is shifted into the guard bit.



Ordinarily, rounding is accomplished by adding .5 to the leftmost digit to be discarded. This technique introduces an upward bias, since the number is rounded up when the remainder is greater than or equal to .5 and rounded down only when the remainder is less than .5. For example, to round 98.9554 to two places, .005 would be added, producing 98.96. The number 98.9550, however, would also be rounded up. An unbiased technique would round a remainder equal to .5 upward half of the time and downward half of the time.

That is where the sticky bit comes in. If the guard bit is 1 and the sticky bit is 1, the remainder is greater than .5; the number will therefore be rounded upward. If the guard bit is 0, the remainder is less than .5, and the number will be rounded downward. If the guard bit is 1 and the sticky bit is 0, the remainder is equal to .5; the number will be rounded to the nearest even

number—upward if the mantissa is odd and downward if it is even.

In figure 5, the number is rounded upward by adding 1 to the guard bit. It would have been just as easy to round to the nearest odd number, but rounding to the even number gives nicer results.


Figure 5 illustrates the situation just prior to rounding the result of an addition or subtraction operation. A sticky bit and one guard bit provide sufficient information for accurate rounding. In addition, two guard bits are kept during the actual addition or subtraction process. The sticky bit is then ORed into the second guard bit just before rounding.

### AN ALGORITHM FOR FLOATING-POINT ADDITION

Addition is probably the most difficult of all floating-point operations, and coding a floating-point addition routine on the 8088 is a challenge. The basic algorithm is, however, fairly straightforward (see listing 1).

Note that the assembly language routine given in listing 1 uses the IBM PC BASIC format, and the operands are passed in the same way. The result is returned in AX:DX. An advantage of this routine is that it is about 20 percent shorter and, presumably, proportionately faster than the routine used in the IBM PC BASIC compiler.

The algorithm shown in figure 6 closely resembles the algorithm used in listing 1; however, it is intended to be essentially machine- and language-independent.

These algorithms, along with the preceding discussion, should provide programmers with all they need to know to do floating-point arithmetic on their IBM PCs. 

### Listing 1: FLOAT.ASM

```

FLOAT_A PROC NEAR
;entry point for subtraction
SUB_F: MOV BX,0080H ;set mask to reverse sign of operand2
        JMP SHORT F1 ;and go to main routine
;
;entry point for addition
ADD_F: SUB BX,BX ;clear mask register BX
;
;get operand1 from address in DI
F1: PUSH SI ;save index registers
     PUSH DI
     MOV DX,[DI]+2 ;exponent goes in DH--mantissa in DL
     MOV AX,[DI] ;and AX
;get operand2 from address in SI
     XOR BX,[SI]+2 ;exponent goes in BH--mantissa in BL
     MOV CX,[SI] ;and CX
;*****
; Floating point addition routine begins here
; operands are in the following format:
; DH DL bit 7 DL AX
;
; Operand1 exponent sign mantissa
;
; BH BL bit 7 BL CX
; Operand2 exponent sign mantissa
;*****
;save signs
MOV SI,10000000B ;put mask for sign bit is SI

```

```

MOV DI,SI ;and in DI
AND SI,DX ;put sign of operand1 in SI bit 7
AND DI,BX ;put sign of operand2 in DI bit 7
;
CMP SI,DI ;
JE A1 ;if signs are unequal
ADD DI,8000H ;set bit 15 to 1. Bit 15 is
ADD SI,8000H ;addition/subtraction flag
;
A1: OR DL,10000000B ;restore leading ones
     OR BL,10000000B
;put smaller operand in DX:AX
CMP DX,BX
JA A2 ;compare first word
JB A3 ;exchange if DX:AX is larger
;
CMP AX,CX ;equal first words; compare second
JA A2
;
JB A3 ;
;operands are equal
OR DI,DI ;if signs are unequal
JNS A3 ;
;set result in DX:AX to zero
SUB DX,DX
MOV AX,DX
JMP EXIT ;and return
;
A2: XCHG DX,BX ;exchange operands
     XCHG AX,CX
     MOV DI,SI ;put sign of larger in DI
;
A3: MOV SI,CX ;larger operand is now in BX:SI
     ;compute exponent difference

```



# FIGURES

	MOV	CL,BH	;put larger exponent in CL
	SUB	CL,DH	;and subtract the smaller exponent
			;CL is COUNT of bits to shift DX:AX
	CMP	CL,24	;if COUNT > 24, smaller operand is
	JLE	A4	;effectively 0, so
	MOV	DX,BX	;put larger operand(result) in DX:AX
	MOV	AX,SI	;
	JMP	FINISH	;and finish
			;ALIGN fractions (shift smaller right)
A4:	SUB	DH,DH	;clear DH
	MOV	CH,DH	;clear CH
A5:	CMP	CL,8	;
	JL	A6	;if COUNT >= 8
			;shift right in byte increments
	OR	CH,DH	;put trailing bits in CH
	MOV	DH,AL	;move leading bits in AL (and any
			;others that happen to be set) to DH
	MOV	AL,AH	;shift upper bytes right
	MOV	AH,DL	;
	SUB	DL,DL	;set leading byte to zero
	SUB	CL,8	;decrement COUNT
	JMP	SHORT A5	;if COUNT >= 8, repeat
A6:	OR	CH,CH	;if any bits set in CH
	JZ	A7	;
	OR	CH,80H	;set sticky bit
A7:	OR	CL,CL	;
	JZ	A9	;if COUNT > 0
			;shift right COUNT bits
A8:	SHR	DL,1	;rotate mantissa in DL:AX right
	RCR	AX,1	;
	RCR	DH,1	;rotate round bits in DH:CH right
	RCR	CH,1	;
	DEC	CL	;decrement COUNT
	JNZ	A8	;repeat if COUNT in CL not zero
	MOV	CL,3FH	;put mask in lower 6 bits of CL
	AND	CL,DH	;pick up rounding bits from DH
	AND	DH,0COH	;zero out all but two guard bits in DH
			;operands are now aligned
A9:	OR	DI,DI	;if signs were the same,i.e., sign
	JS	A10	;bit = 0, then
	ADD	AX,SI	;ADD the two operands
	ADC	DL,BL	;
	JNC	R0	;if there was a carry, fraction is
			;greater than 0, so normalize
	INC	BH	;increment exponent
	JZ	OVER_F	;jump if exponent overflow
	RCR	DL,1	;shift fraction right one bit
	RCR	AX,1	;
	RCR	DH,1	;
	JMP	SHORT R0	;
			;SUBTRACT the two operands

A10:	XCHG	SI,AX	;put larger operand in DL:AX
	XCHG	DL,BL	;
	NEG	DH	;subtract DH (guard bits)
	SBB	AX,SI	;subtract significant portions
	SBB	DL,BL	;
	JS	R0	;if DL bit 7 is 1, round
			;NORMALIZE
A11:	DEC	BH	;decrement exponent
	JZ	UNDER_F	;jump if exponent underflow
	SHL	DH,1	;shift mantissa left
	RCL	AX,1	;
	RCL	DL,1	;
	OR	DL,DL	;
	JNS	A11	;repeat if still not normalized
R0:	OR	CH,CL	;set sticky bit before rounding
	JZ	R1	;if any trailing bits in CX
	OR	DH,01000000B	;set sticky bit in DH
			;ROUND normalized result
R1:	OR	DH,DH	;if guard bit in DH is 0,
	JNS	FINISH	;rounding is not necessary
			;guard bit is on
	TEST	AL,1	;if fraction is odd, then
	JNZ	R2	;round it
	AND	DH,7FH	;check trailing bits in DH and CX
	JZ	FINISH	;if all zeros, rounding not needed
R2:	ADD	AX,1	;round by adding one
	ADC	DL,0	;
	JNC	FINISH	;rounding may denormalize mantissa
	RCR	DL,1	;normalize by shifting right one
	RCR	AX,1	;
	INC	BH	;increment exponent
	JZ	OVER_F	;jump if exponent overflow
FINISH:	AND	DL,7FH	;set sign bit to 0
	OR	DX,DI	;restore sign from bit 7 of DI
	MOV	DH,BH	;put exponent in DH
	SUB	BX,BX	;set status=0 -- OK
EXIT:	POP	DI	;restore index registers
	POP	SI	;
	RET		
OVER_F:	MOV	DX,0FF7FH	;here for overflow--set result in DX:AX
	MOV	AX,0FFFFH	;to maximum possible value with positive
	OR	DX,DI	;sign. Restore actual result sign.
	MOV	BX,1	;set status=1 -- overflow
	JMP	SHORT EXIT	;
UNDER_F:	SUB	DX,DX	;set result in DX:AX to zero
	MOV	AX,DX	;
	MOV	BX,-1	;set status=-1 -- underflow
	JMP	SHORT EXIT	;
FLOAT_A	ENDP		



# Talking to a Mouse from Turbo Pascal

TECH  
NOTEBOOK  
24

*Using Turbo's INTR routine to make  
mouse function calls*

JEFF DUNTEMANN

When I got Turbo Pascal V2.0, which has some graphics capabilities, my first test was to make it talk to the Microsoft Mouse. It turned out to be fairly easy, thanks to a marvelous Turbo Pascal built-in routine called INTR. This routine allows the tripping of any software interrupt from within a Pascal program. Turbo Pascal predeclares INTR in the following way:

## PROCEDURE

**INTR(INTERRUPT :  
<INT\_CONST>, VAR  
REGISTERS : REGPACK),**

INTR takes two parameters: the number of the software interrupt and a record that contains register and flag values to be passed to the interrupt routine to be tripped. <INT\_CONST> must be an in-


teger *constant*, not a variable. REGISTERS is a record type that must be explicitly declared:

**TYPE REGPACK = RECORD  
AX,BX,CX,DX,BP,SI,DI,DS,  
ES, FLAGS : INTEGER END;**

Any values to be passed to the interrupt routine must be assigned to the appropriate field in REGISTERS before the interrupt is tripped. If the interrupt routine returns any values in the registers, these values are available when the interrupt returns control to the program.

Making a call to the Microsoft Mouse driver routine is done by placing parameter values into the AX, BX, CX, and DX registers and tripping software interrupt 51 (33 hex). The number of the function calls goes into AX; the remaining

three registers hold optional parameters that depend on the mouse function call desired. Return values from the function call (if there are any) come back in the same registers. The Microsoft Mouse User Guide describes the parameters and return values fairly well.

The program MOUSKETCH, which acts as a minimal freehand sketch pad, illustrates the use of Turbo Pascal's INTR routine for making mouse function calls. To draw, hold down either mouse button and move the mouse. The user can draw fairly quickly, but overly rapid strokes will cause gaps and kinks in the line that appears on the screen. Any key press will terminate the program. 

*Jeff Duntemann is a programmer for Xerox Corporation in Rochester, New York.*

## Listing 1: MOUSKETCH.PAS

```
{ MOUSKETCH }
{ by Jeff Duntemann }

PROGRAM MOUSKETCH;

TYPE REGPACK = RECORD
    AX,BX,CX,DX,BP,SI,DI,DS,ES,FLAGS : INTEGER
END;

VAR OLDX,OLDY,X,Y : INTEGER;
    M1,M2,M3,M4 : INTEGER;
    REGSET : REGPACK;

PROCEDURE MOUSE(VAR M1,M2,M3,M4 : INTEGER);

VAR REGSET : REGPACK;

BEGIN
    WITH REGSET DO
        BEGIN
            {Set up AX/BX/CX/DX for interrupt}
            AX := M1;
            BX := M2;
            CX := M3;
            DX := M4;
        END;
```

```
INTR(51,REGSET); {Trip interrupt 51}

WITH REGSET DO
    BEGIN
        {Put return values back into M1-M4}
        M1 := AX;
        M2 := BX;
        M3 := CX;
        M4 := DX;
    END;

BEGIN
    HIRES; {Choose graphics mode & color}
    HIRESCOLOR(YELLOW);
    M1:=0; {Init mouse driver}
    MOUSE(M1,M2,M3,M4);
    M1:=1; {Turn mouse cursor on}
    MOUSE(M1,M2,M3,M4);
    M1 := 3; OLDX := 0; OLDY := 0;
    WHILE NOT KEYPRESSED DO {Exit MOUSKETCH when any key pressed}
        BEGIN
            MOUSE(M1,M2,M3,M4);
            IF M2 <> 0 THEN DRAW(OLDX,OLDY,M3,M4,1); {Draw if button pressed}
            OLDX := M3; {Update old X/Y values}
            OLDY := M4;
        END;
    END.
```



# MULTITA

An artistic illustration of two hands, one holding a pen and the other holding a small object, with a large, stylized eye in the background.

*MultiLink for the IBM PC enables more than one user to do more than one job at more than one terminal.*

Although the ability to run more than one program concurrently on a single machine is not a new concept in computing—multitasking operating systems were developed through the 1960s and

J. ERIC ROSKOS



# LENTED





# MULTILINK

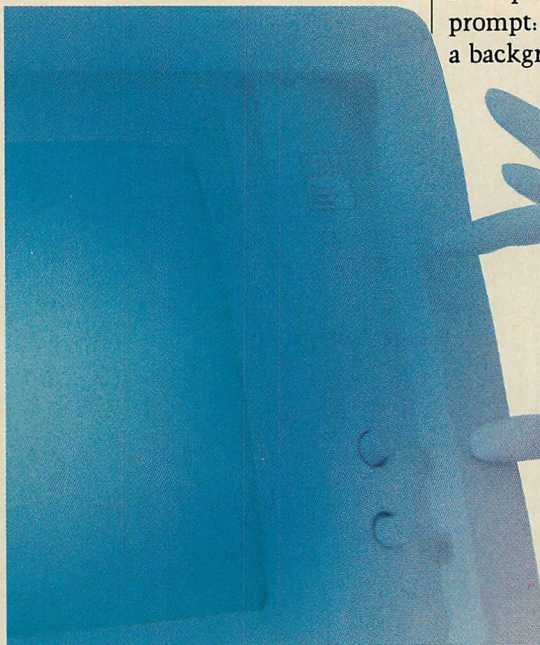
1970s on mainframe machines—it is a relatively new talent for personal computers. It was not until fast, relatively high-performance microprocessors became available for personal computers, giving them the power to run concurrent tasks satisfactorily, that multitasking became a popular word in the software development field.

PC-DOS does not presently have a multitasking version available. There are, however, several software products that attempt to add multitasking to the existing versions of PC-DOS, with varying degrees of success. One such product is MultiLink from The Software Link, Inc. (not to be confused with Davong's MultiLink local area network). This review will discuss version 2.07 of the MultiLink package.

MultiLink claims to be not only a multitasking system, but also a multi-user system. The two concepts are distinct, and in evaluating such products it is important to realize the difference. Computer operating systems can be roughly divided into three categories: (1) PC-DOS alone is a single-tasking, single-user operating system in which only one person can use the PC, and only one program can be run at a given time; (2) most older mainframe time-sharing systems are multi-user systems, which, from the viewpoint of a single user, *appear* to be single-tasking systems because a user can run only one program at a time from his terminal. In reality, however, such a system is usually multitasking because it is running many users concurrently; (3) newer systems, such as UNIX, allow multiple users and allow each user to run more than one task from his terminal.

MultiLink is in the second of these categories, having reached what might be considered the second step in the evolution of multi-

tasking systems. However, it provides an extension to the multi-user, single-task concept that allows someone at the PC's keyboard to switch among several tasks. This capability is different from that of sys-



tems like UNIX, which has a more generalized multitasking capability.

## USING MULTILINK

The MultiLink program is started in much the same way as the PRINT command of DOS 2.0, which also attempts to provide limited multitasking. Fortunately, MultiLink's operation is much less erratic.

Typing the command MLINK (along with a string of configuration parameters) causes MultiLink to begin executing. A copyright notice is displayed on the screen, but then the program appears to exit, returning the user to the command prompt. During the brief interval that the program runs, however, it is installing itself in memory as an extension of DOS and will remain there until the system is rebooted.

After MultiLink has been started, nothing at first seems different from regular PC-DOS. An A> prompt still is displayed on the screen, and the system still accepts

commands as usual. However, the ability to switch to one or more "background partitions" is now available; this is done by pressing ALT-Fn, where n is the number of the partition that is to be accessed. Each partition has its own command prompt: thus the user can switch to a background partition; start a compiler, print-formatting program, or other program requiring little keyboard interaction; and then switch back to the main (foreground) partition.

tion and continue to work while the other program is running. Alternately, if a conventional terminal is available, it may be plugged into the PC's COM

port, and a second user can run programs there at the same time the first user is running programs from the PC's keyboard.

At the time MultiLink is started, the user must specify the size of one or more *partitions* in which tasks may run. The size and number of partitions may not be altered once MultiLink has started. This concept of "memory partitioning" first appeared many years ago in mainframe multitasking systems, and it represents an evolutionary step that precedes the current state-of-the-art. Nevertheless, with proper planning memory partitioning can be used with no problems, although it is not as flexible as the more recently developed dynamic memory allocation schemes used by UNIX and similar systems.

In memory partitioning, if the user allocates one 192K and one 64K partition on a 256K system, he will not be able to run two 90K programs at the same time, even

*J. Eric Roskos is a graduate student in computer science at Vanderbilt University. His dissertation is on a new architecture for shared memory in multiprocessor systems.*



though there would be 76K of memory left over if both were running. This is because MultiLink creates the illusion that two PCs are being used—one with 64K and one with 192K; and clearly a 64K machine could not run a 90K program.

The fact that some memory must be used by both DOS and MultiLink must also be taken into account. Unlike some of the more primitive multitasking systems for the PC, MultiLink requires only one copy of DOS to be loaded into memory. This saves some space. MultiLink takes up about 13K for its own software, plus about 9K per partition "for buffers and other system areas," in addition to DOS. MultiLink loads multiple copies of COMMAND.COM—one per partition—accounting for part of the 9K. However, the 9K is sufficiently small that no serious memory space limitations are likely, assuming the system has adequate memory to run multitasking in the first place.

Because of the fixed partitions and the size of most programs that run under PC-DOS, at least 128K of memory would seem to be advisable for a PC running MultiLink. With just two partitions, this gives less than 64K each. The system on which I tested MultiLink had 320K; it was run with one 128K partition. Any memory not allocated to a partition at start-up time is given to the "foreground partition"; based on the CHKDSK command, it appeared that the foreground partition had 141K available, which amounts to about 50K of overhead. Considering DOS (24K), a 3K device driver, 9K for the one background partition, and the 13K MultiLink overhead, this adds up to 49K. I specified FILES=16 in my CONFIG.SYS file in order to overcome a problem with file usage (described below). The 312 bytes this added, plus a little room for rounding error in size estimates, seems to show that the MultiLink manual's estimates are correct. (These calculations were

done under version 2.06. Version 2.07 adds 3K to the size of the resident portion of MultiLink as a result of program enhancements.)

### HOW IT WORKS

MultiLink works by installing itself between the operating system and the programs that run on the PC. Whenever a program calls up DOS (or in some cases the ROM BIOS), the program must first go through MultiLink, although this process is invisible to the program. MultiLink can then decide that it's time to run one of the other concurrently active

programs, and it gives control of the system to the new program instead of continuing the original program that made the call to DOS. According to the manual, it does this after 1/18 second has elapsed. In fact, a considerably longer time, possibly even several minutes, could pass in the case of a program that rarely calls DOS, were it not for an optional feature known as *time-slicing*.

Time-slicing assures that a program in a multitasking environment gets its fair share of time at sufficiently regular intervals. This time situation is one that is often overlooked in simplified descriptions of multitasking, which say that the system works by running a second task while the first is waiting for some event such as I/O. In reality, a multitasking system that worked only in this way would behave very erratically. In many cases, the waiting time would be far too brief to allow two or more concurrent tasks to make reasonable progress.

In time-slicing, the multitasking system keeps track of how long the currently running task has been executing. If the task does not voluntarily allow other tasks to run after a certain amount of time has elapsed by waiting for I/O, the system stops the task anyway and allows other tasks to run for an equal time. The amount of time each task is allowed to run is called the *quantum* and is typically between 1/20 of a second and 1 second.

To use MultiLink's time-slicing option, the command MLSLICE must be given before MultiLink is started. Without the command, MultiLink will switch between tasks only when DOS is called. This involves less byte overhead, but can make operation erratic when running programs that call DOS rarely.

### HOW WELL DOES IT WORK?

Considering that DOS was not designed to support multitasking, MultiLink does a surprisingly good job. It is not perfect, however. Both



# MULTILINK

DOS and the hardware have some limitations that noticeably affect performance. Furthermore, MultiLink is still growing and thus currently lacks some features that would be useful.

The IBM PC was not designed to support multitasking. Machines designed for such a capability usually contain features that insure a program running on the system cannot interfere with the other concurrently running programs, either by accident or intentionally. On the PC, however, each program can address all of memory and invoke all possible system functions; thus, one task can destroy another task's program or data by writing over the part of memory in use by the other task. Likewise, a task can cause the system to fail by branching wildly to some unused location in memory, by issuing commands that keep MultiLink from

MultiLink and functions as if only one program were running at a given time. Thus, three problems can often occur when the system is being used. Two of these problems can be catastrophic.

First, if one of two programs under MultiLink opens a large number of files using the DOS 2.0 file system functions, then the maximum number of files that may be simultaneously opened may be exceeded when the second program tries to open its files. This may cause the second program to fail.

More importantly, it may fail differently at different times, depending

on what is going on in the other partition. The second program should be able to handle this; but, since the error involved would not normally occur under plain DOS, it is possible that the author of the program would not have anticipated the occurrence of such an error.

This happened to me with a small database program, causing the size of the database file to be truncated to zero when the program reported a fatal error and exited. The programmer obviously reasoned that if such an error ever occurred, since the program clearly wasn't opening that many files itself, the problem would lie in DOS rather than his program. Whatever the reason, the effect on this program was deletion of the data file; in other cases, the results might not be so severe.

A second problem can result from user error. Until the user be-

comes accustomed to running MultiLink, he may forget that another program is quietly running in a background partition. If he were to change disks at this point he would destroy the running disk's file allocation table, causing all files on the disk to become inaccessible. (In some cases, the RECOVER command will get them back, although this is very time consuming.) For this reason, MultiLink is probably better suited for systems with a hard disk than for those with only floppy disks, because the limited capacity of floppy disks sometimes makes changing them a necessity.

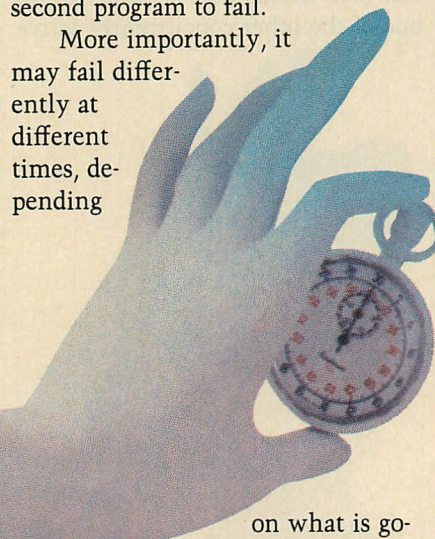
The third limitation of multitasking on a PC is purely aesthetic in nature. On a large time-sharing system, a character typed at a terminal is immediately echoed on the display even if another task is concurrently running, preventing the system from doing anything with the character at that time. This gives the illusion of better responsiveness. Since some waiting is usually needed in such a case anyway, this form of delay is usually more tolerable than echo delays, unless it exceeds several seconds.

Unfortunately, to do this, a program must tell the operating system in advance whether or not it should echo characters. DOS does not provide this capability. Although it is possible to make a good guess about echoing, ultimately DOS does not require the program to specify the echo/no echo attribute until a character is actually read. This means that in order for echoing of a string of input characters to occur, the tasks that use them must be running. Since, in a two-task system with both tasks attempting to run, half of the time a given task will not be running, half of the time there will not be an immediate echo. The probability of no echo increases with more tasks. Whether or not the echo delay is acceptable depends entirely on the individual user; but it makes performance

regaining control (such as a command that turns the clock), or even by invoking the reboot function provided in the ROM BIOS.

It is worth noting that some of these problems can be avoided on the PC if each user is content with a maximum of 128K. The often-criticized "small memory model" provided by many compilers can prevent, at least, overwriting of data in memory, if each program is placed outside the 128K range that the other programs are able to address. In fact, the small memory model also provides some other multitasking advantages that are beyond the scope of this article; but it does not prevent all the ways in which a program can cause the system to fail.

Another problem involved in multitasking has to do with DOS itself. DOS is a single-user operating system; it doesn't know about





## Debugging MultiLink

Perhaps the most serious problem discovered during the review of MultiLink was interference with the prototype board, which required a hardware modification to the PC.

Since the problem involved MultiLink's writing to an I/O port somewhere within the 13K program, and since MultiLink does a lot of writing to I/O ports throughout, using the debugger to search for I/O instructions would have taken a long time and would have been inexact.

A logic analyzer could be connected to the CPU to watch for I/O to the port in question. But since I don't have access to a logic analyzer, I made the PC serve that function.

To do this, I connected pin 8 of U4 on the IBM prototype board to pin B4 of the expansion slot into which the prototype card was plugged. Pin 8 of U4 generates a logic "high" pulse whenever the prototype board's I/O ports are written to; and pin B4 of the expansion slot is the interrupt request line for interrupt type 2. When pin B4 gets a logic "high" pulse, it generates an interrupt of type 2, causing a branch to the interrupt vector at address 28H in RAM. Thus, the hardware modification would cause an interrupt whenever MultiLink wrote to the prototype board.

Next, I wrote a simple program (shown in listing 1) that installed itself in much the same way MultiLink does, establishing itself in memory and pointing the interrupt vector at 28H to a routine within the program. This routine would display the address at which the interrupt occurred (which was stored on the stack by the 8088 when the interrupt occurred), then return. The net effect was that, whenever the prototype board was addressed, the address of an instruction immediately following the instruction that wrote to the prototype board would be displayed on the monitor, but the program would continue execution.

This quickly pinpointed the problem areas, shown in figures 1 and 2. (In these displays, 100H must be added to any addresses in the instructions. The debugger shows offsets relative to the start of the program segment prefix, but MultiLink was assembled without the ORG 100H instruction that accommodates for the PSP in .COM programs.)

```

365F:3290 E966FE      JMP     30F9
365F:3293 1E          PUSH    DS
365F:3294 8E1E6C00      MOV     DS,[006C]
365F:3298 BA8000      MOV     DX,0080
365F:329B B41A      MOV     AH,1A
365F:329D CD21      INT     21
-e 20f4
365F:20F4 00.      03.
-u 3279
365F:3279 8B16F41F      MOV     DX,[1FF4]
365F:327D 42          INC     DX
365F:327E FA          CLI
365F:327F EE          OUT     DX,AL
365F:3280 FB          STI
365F:3281 B019      MOV     AL,19
365F:3283 B500      MOV     CH,00
365F:3285 B618      MOV     DH,18
365F:3287 E8F9F2      CALL    2583
365F:328A 81EEB000      SUB     SI,00B0
365F:328E 7E03      JLE     3293
365F:3290 E966FE      JMP     30F9
365F:3293 1E          PUSH    DS
365F:3294 8E1E6C00      MOV     DS,[006C]
365F:3298 BA8000      MOV     DX,0080

```

Figure 1: First Debugger Display

During start-up, as shown in figure 1, MultiLink clearly writes to the prototype board at I/O address 300H. It does this at address 327F in the debugger display; it loads the DX register with the word at location 1FF4 (20F4 after adding 100H to it), which contains the number 300H. It then outputs the value in the AL register to that address, which is the first address on the prototype board.

This, in fact, appears to happen inside a loop that initializes the partition tables, because right after it does the OUT instruction, it subtracts B0H from the SI register, and if the result is not zero, it branches back to an address earlier in the program. Since B0H is the size of one entry in the partition table, according to the MultiLink manual, the initialization loop appears to be for the partitions. This was supported by the I/O tracer, which showed that the prototype board was accessed twice in rapid succession, with the background partitions set up at the time.

Although this first case clearly seems to be an intentional write to the prototype board, the second case (shown in figure 2), which occurs when the function keys are depressed, could simply be a programming error. Again, an OUT instruction occurs at address 1209H. But the DX register, which points to the I/O port, is initialized long before this; two subroutine calls (to save or restore the display memory when switching partitions) take place in the meantime.

Although it is not shown in listing 1, the DX register is loaded in a very roundabout way—by POPping its value, which was PUSHed there even earlier in the program, off the stack. Since the write to the prototype board occurs only occasionally and involves seemingly random values, this example may be an error in the program resulting from the roundabout way in which the DX register is set up.

To eliminate the interference with the prototype board, both OUT instructions were changed to NOP instructions. Although it is not clear exactly what the instructions did, MultiLink's single-user mode works properly, and MultiLink no longer interferes with my prototype board.

—J. Eric Roskos

```

-
-
-
-
-
-
-
-
-u 11f0
35D2:11F0 26          ES:
35D2:11F1 8A3E6204      MOV     BH,[0462]
35D2:11F5 B402      MOV     AH,02
35D2:11F7 E8BE0C      CALL    1EB8
35D2:11FA 8E063C09      MOV     ES,[093C]
35D2:11FE 33FF      XOR     DI,DI
35D2:1200 BE2A25      MOV     SI,252A
35D2:1203 B9A00F      MOV     CX,0FA0
35D2:1206 E8B600      CALL    12BF
35D2:1209 EE          OUT     DX,AL
35D2:120A 5E          POP     SI
35D2:120B E98500      JMP     1293
35D2:120E 39065A00      CMP     [005A],AX

```

Figure 2: Second Debugger Display



# MULTILINK

seem worse than it is, and it makes it take longer for a fast typist to feel comfortable with the system.

Despite these limitations, MultiLink has some powerful features. Version 2.07 supports a wide variety of terminals for those who want to use their machines as multi-user systems. A program that writes only to the display through DOS or BIOS calls will work very well on a remote terminal under MultiLink. A program that writes directly to the screen memory, however, may or may not work.

MultiLink provides a program called MLVIDRAM that is supposed to help in this case. The version 2.06 manual claimed that MLVIDRAM is documented separately for those familiar with assembly-language programming, but no documentation on how to use this program was provided except for a set of the more popular applications programs. The 2.07 manual deletes this reference altogether. The program MLVIDRAM works for many popular applications programs, however, and the company seems willing to enhance it for any programs that are not supported.

MLVIDRAM is used in conjunction with a program called MLVIDFIX. A batch file must be created to run MLVIDFIX, which patches the applications program before each execution in order for it to run in a particular partition. Because of the way MLVIDFIX works, a slight possibility exists that the program could fail if two users tried to start the same application at the same time (since both users would be trying to apply different patches to the same program).

## PROGRAMMING INTERFACE

MultiLink provides a number of advanced functions via interrupt 7FH, which is invoked in the same way as the DOS interrupt 21H functions. The advanced functions include an implementation of the enqueue/dequeue synchronization primitives;

the ability to read and set some—but not all—of the serial port's control/status bits; an unusually straightforward way to set the baud rate for the serial ports; the ability to change the terminal type for a remote port on a multi-user configuration; and several features that improve system performance. Some of the latter features, particularly one intended to suspend a task if it is

***This is the most impressive feature of the MultiLink system: an elegantly implemented spooler that is simple and yet effective.***

not being useful, seem to have been provided to overcome limitations in compiled BASIC and don't always work with other languages.

The advanced functions are further enhanced by a detailed description of MultiLink's internal status table; some functions that are not available through interrupt 7FH may be simulated by modifying this status table appropriately.

A few useful functions are missing at present. The ability to specify echoing of characters to overcome the echo delay problem would be helpful. Another valuable addition would be the ability to take control of a serial port that is normally assigned to a remote partition for use by another task; this would be useful, for example, for the user who has a modem connected to his serial port so people can dial up the modem and use the system, but who also wants to be able to run a terminal emulator using the modem from time to time. (MultiLink provides a way to do this if the serial port is not assigned to a partition. I found, by trial and error, another way to accomplish this by using modifications to the system status table.)

A generalized event wait function, which would cause a task to cease running until some external event occurred, would be helpful in improving MultiLink's multitasking performance. This is partially implemented now, but it is difficult to use effectively. The company claimed at the time version 2.06 was released that a generalized event wait would be added in the future, but it was not added to version 2.07.

A priority-scheduling function is also available, but the method presently used is of limited utility in an interactive system, since it allows a higher-priority task to "lock out" a lower-priority one, rather than simply scheduling higher-priority tasks more frequently than lower-priority ones.

## UTILITY PROGRAMS

Several utility programs are provided with MultiLink. The best of these is a new print spooler provided with release 2.07. This is by far the best print spooler for the IBM PC; its operation is similar to that of mainframe print spoolers. When the spooler is activated, all output to the printer (regardless of whether it was output through BIOS calls or through the device PRN) is sent to a disk file. The disk files are normally closed when a program exits, so that a separate file is created for each run of a program. A separate print program, which runs in an 18K partition, scans a user-specified directory every few seconds for a new file to print.

The spooler allows the user to specify disposition (Keep, Delete, etc.), priority, and class (used to designate special forms) for each print job. A continuously updated display is kept in the print program's partition, showing what the spooler is currently doing and enabling the user to give spooler commands. This is the most impressive feature of the MultiLink system: an elegantly implemented spooler that is simple and yet effective.



In addition to the spooler, a bulletin board system, MLBBS, is provided. Although not as flexible as some bulletin board systems, it is a pleasing program to use. The source code, which is included, is written in a dialect of BASIC that allows named line labels instead of line numbers. A preprocessor converts this file to a standard BASIC file.

A few support programs are also part of the MultiLink package. One such program is a "keyboard enhancer" that functions similarly to the ANSI.SYS device driver's function-key-assignment feature: any key can be translated to an arbitrary string. Furthermore, the input to the translation process can be a short string, such as the escape sequences sent by many terminals, so that a terminal's function keys can be assigned to strings at the remote ports. The program that is used to make these assignments is highly interactive. Since MultiLink also provides a set of escape sequences to simulate the PC's function keys, the user is able to translate from the terminal's function keys to the PC's function keys, if those keys are available on the terminal.

A general parameter-setting program is also provided; this program allows the user to set the terminal type, baud rate, priority, and other attributes of a partition.

One utility that comes with release 2.07 of MultiLink is amusing, although it could be frustrating as well. According to the manual, if the user has a terminal not currently supported by MultiLink, he can specify terminal type 9 and define this terminal to MultiLink via the program MLCUSTOM. This program, the manual says, also lets the program be configured for non-standard serial cards. A sample run of the program came up with the following message:

Call us at (404) 255-4210 if you need help with installation of serial ports or terminal type 9.

This may be merely a case of the manual being ahead of the software development; no doubt MLCUSTOM will be available in a future release in a more useful form.

### PROBLEMS

Most of the problems that existed in version 2.06 were fixed in version 2.07. One minor problem continued in version 2.07, affecting the multi-use feature via a dial-up modem: the program seems to send cursor-positioning escape sequences before every character sent to the terminal, even when they are unnecessary, so that the actual rate at which characters appear on the terminal's screen is noticeably slower than would otherwise be the case. This made output "sluggish."

**One other minor problem is that MultiLink will not allow use of the DOS ASSIGN command prior to start-up. If MultiLink detects that an ASSIGN command has been used, it outputs an error message and aborts start-up.**

Additionally, version 2.07 does not take advantage of the COMMAND.COM feature (under DOS 2.0) that allows the user to specify the directory in which COMMAND.COM can find its nonresident segment. When MultiLink was tested in conjunction with Turbo Pascal, the system came to a complete halt in all partitions as soon as the user running the compiler exited Turbo. COMMAND.COM tried to reload its transient portion

and looked for the file on the currently logged disk, rather than looking on the disk from which COMMAND.COM was first loaded.

Another minor problem is

that MultiLink will not allow use of the DOS ASSIGN command prior to start-up. If MultiLink detects that an ASSIGN command has been used, it outputs an error message and aborts start-up. This is not too serious, but it requires a separate AUTOEXEC.BAT file for each partition if device letter assignments must be made. Then the user will be able to give the ASSIGN commands after MultiLink has started.

Although version 2.07 fixed many of the minor problems of 2.06, one very irritating and serious problem was actually made worse in the new release. In version 2.06, MultiLink would output a byte to the IBM prototype board during its initial start-up. On a system that has some sound-producing devices on the prototype board, this can be quite bothersome, and requires writing a program to be run by the boot disk's AUTOEXEC.BAT file in order to turn the devices off. This results in loud noises coming from the prototype board whenever the system is booted. The situation could be more serious for those who use the prototype board to interface to laboratory equipment.

In release 2.07, data are written to the prototype board not only when the system is started up but also almost every time the function keys are used to switch between



# MULTILINK

partitions. Furthermore, the data being output seem more random than in version 2.06.

This problem seems to be connected to another bug. When accessing a background partition, the cursor is displayed as a large block cursor. In the foreground partition, it is displayed as a blinking underline—at least, it is supposed to be. Sometimes, for no apparent reason, the foreground partition's cursor appears as a small square, raised above the characters' baseline in the position where an exponent would be. Whenever this cursor appears, for some reason, the prototype board problem seems to disappear.

## DOCUMENTATION, USER SUPPORT, AND PRICE

Documentation consists of a 61-page booklet the same size as the standard IBM documents. This is a considerable improvement over the version 2.06 manual, which was much shorter. The documentation describing the programming interface has not been significantly expanded from the previous manual, but the level of detail is comparable to that of the DOS 2.0 manual's documentation of system calls.

In the realm of user support, the Software Link provides a dial-up bulletin board for MultiLink users. The bulletin board provides up-to-date copies of the documentation, as well as a few utility and game programs, and occasional information on other programs.

In mid-March, the Software Link announced a change in its user

support policy: it now provides only 30 days of free user support; thereafter, the user must choose between paying \$95 per year for the "Service Link" one-year support plan or paying for "time and materials" on a per-call basis. At the time of the announcement of this new policy (which replaced a no-charge user support program) the company raised the price of MultiLink by \$70. This price increase could be questioned in light of the copy-protection of the diskette and the additional charge for user support; many software companies use the problem of software piracy and the cost of user-support to attempt to justify their high prices.


MultiLink's version 2.07 now costs \$295, although a demo version is available for \$25. With patience, the user can give the program a thorough workout using the demo version. It is identical to the standard system, except that it quits scheduling tasks to run after 7 minutes, effectively halting the system. The program is copy-protected, requiring the original program disk to be inserted when the system is first started. The program disk may be reformatted (but not bulk-erased) without destroying the copy-protection function. The protection scheme is described as a "finger-print" method, although it is simpler than the Prolok scheme usually described by this term.

Although MultiLink does not represent the state-of-the-art in multitasking software in comparison to other operating systems available for

the IBM PC, it does a reasonably good job and is certainly a good choice for those needing multitasking under PC-DOS.

The product's high price, compounded by the optional service contract, places it at the upper boundary of price/performance.

Several other companies have already produced multitasking operating systems for the IBM PC, including both Concurrent CP/M-86 and PCIX (IBM's own adaptation of Bell Labs' UNIX Time-sharing System), and it is likely more and more multitasking software will emerge. It is possible that a future release of PC-DOS could include multitasking. Such an enhancement to DOS would most likely make multitasking add-ons obsolete, unless the new DOS implementation had fairly serious performance problems.

For now, MultiLink provides a very good way to enjoy multitasking advantages while still having access to the large body of software that runs under PC-DOS. 

## MultiLink

*The Software Link, Inc.*  
6700 23-B Roswell Road  
Atlanta, GA 30328  
404-998-0700

\$295

CIRCLE 490 ON READER SERVICE CARD

## Listing 1 INTRACE Display Whenever an Interrupt Type 2 Occurs

page 56,132  
title INTRACE Display whenever an interrupt type 2 occurs  
.sall

```
;
; Program to display the interrupted address whenever an interrupt
; of type 2 occurs. This is used to find out where MultiLink is writing
; to the IBM Prototype Board.
```

```
;
; If this program seems to have some superfluous code, it's because it
; was originally used in tracing disk I/O calls to debug a device
; driver...
```

```
;
; Macros
```

```
;
; wto: write message to display. Append cr/lf unless crsup=nocr
```



```

;
wto macro msg,crsup
    local msgstr,around

    jmp around

msgstr db msg
ifb <crsup>
db 0DH,0AH
endif
db '$'

around: push ax
        push bx
        push si
        push di
        push bp

        mov si,offset msgstr
        call putc

        pop bp
        pop di
        pop si
        pop bx
        pop ax

    endm

prtreg macro rg,msg ; put register rg with message msg on display

    push ax

    mov ax,rg
    call prtax
    wto msg,nocr

    pop ax
    endm

;
; Code Segment
;

cseg segment para public 'code'
    assume cs:cseg,ds:cseg,ss:cseg,es:nothing

    org 100H

;
; COM program startup
;
cpstart proc far
        near ptr start
cpstart jmp endp

;
; Local Procedures
;
putc proc near ; write a string to display W/O DOS
        ; intervention
        mov bl,7 ; Parameter setup same as for DOS's
        ; write-string
        mov bh,0 ; function

putc1: mov al,cs:[si]
        cmp al,'$'
        je putc2
        mov ah,14
        int 10H
        inc si
        jmp putc1

putc2: ret

putc endp

```

```

prtnum proc near ; print half a byte on screen
        push ds ; this procedure is used by prtax below
        push cs
        pop ds
        push bx
        mov bx,offset xltab
        xlatb
        mov ah,14
        mov bh,0
        int 10h
        pop bx
        pop ds
        ret

xltab db '0123456789ABCDEF'
prtnum endp

prtax proc near ; print contents of ax register
        ; on screen
        ; all registers are preserved
        push cx
        push ax
        mov al,ah
        mov cl,4
        shr al,cl
        call prtnum
        pop ax
        push ax
        mov al,ah
        and al,0Fh
        call prtnum
        pop ax
        push ax
        mov cl,4
        shr al,cl
        call prtnum
        pop ax
        push ax
        and al,0Fh
        call prtnum
        pop ax
        pop cx
        ret

prtax endp

;
; this routine does the actual display of the interrupted location
;

sssav dw ?
spsav dw ?
axsav dw ?

lsbottom db 1024 dup (?)
lstack dw 0

tracer proc near

;
; establish our environment
; we turn off ints here for old 8088s with defective
; microcode
; (e.g., mine)
;

cli
mov cs:axsav,ax ; switch stacks
mov cs:sssav,ss
mov cs:spsav,sp
mov ax,cs
mov ss,ax
mov sp,offset lstack
sti

mov ax,cs:axsav ; get ax back

;
; print address to which the RTI will return
;

```



```

push    ax
push    bx
push    es

mov     es,cs:sssav
mov     bx,cs:spsav

wto     "int2: ",nocr
prereg  es:2[bx],": "
prereg  es:[bx], " "
wto     " "

pop     es
pop     bx
pop     ax

mov     al,20H          ; signal EOI
out     20H,al
mov     ax,cs:axsav

;
; reestablish original environment
;

cli
mov     ss,cs:sssav      ; restore stack
mov     sp,cs:spsav
sti

fret

tracer      endp
;

```

```

; everything below this point will be deleted from memory once the
; initial command exits
;

start      proc    near

wto        "Installing interrupt trace."
mov        ax,0
mov        es,ax

mov        ax,offset tracer
mov        word ptr es:28H,ax
mov        ax,cs
mov        word ptr es:2aH,ax

wto        "Enabling interrupt"

mov        al,088H
out        21H,al
mov        al,20H
out        20H,al

wto        "Interrupt enabled"

wto        "Installation complete; executing TSR."
mov        dx,offset start
add        dx,100H ; a little extra space...
int        27H

start      endp

cseg       ends

end        cpstart

```

**UNPARALLELED  
PERFORMANCE  
and PORTABILITY  
in an ISAM PACKAGE  
at an UNBEATABLE  
PRICE**



**c-tree™**  
BY FAIRCOM

2606 Johnson Drive  
Columbia MO 65203  
314-445-6833

The company that introduced micros to B-Trees in 1979 and created ACCESS MANAGER™ for Digital Research, now redefines the market for high performance, B-Tree based file handlers. With c-tree™ you get:

- complete C source code written to K & R standards of portability
- high level, multi-key ISAM routines and low level B-Tree functions
- routines that work with single-user and network systems
- no royalties on application programs

## \$395 COMPLETE

Specify format:

8" CP/M® 5¼" PC-DOS 8" RT-II

for VISA, MC or COD orders, call toll free  
1-800-232-3344

Access Manager and CP/M are trademarks of Digital Research, Inc.  
c-tree is a trademark of FairCom.

© 1984 FairCom



# We just made IBM's PC/XT 20 times more powerful.

**Introducing Dragon's New 65 Mb and 140 Mb Hard Disk Drives.**



\$4995

Now available for  
immediate delivery.

\$6995

**What makes Dragon the  
best hard disk drive for the  
IBM PC, XT, and compatibles?**

## **Larger Storage Capacity...**

With 65 Mb of on line storage, the SP-65 holds up to 57 Mb of formatted data. The SP-140 stores up to 121 Mb of formatted data with a total capacity of 140 Mb. No 5¼ inch Winchester stores more than these new Dragon Disks.

## **Faster Access Time...**

At 30 msec. average access time, the SP-65 and SP-140 are faster than other 5¼ inch Winchesters... 3 to 4 times faster.

## **Better Features...**

The SP-65 and SP-140 come with hard disk, controller, host adapter, power supply, cables, and chassis. Both systems are compatible with PC-DOS and MS-DOS.

## **More Options...**

Additional options include: Dual drives with up to 280  
CIRCLE NO. 144 ON READER SERVICE CARD

Mb of on line storage (or 260 Mb formatted). Streamer tape and random access back up. 90 day warranty. Responsive technical help.

For more information, contact Dragon Industries, 35 Main Street, Hopkinton, Mass., 01748, (800) 824-8006 or (617) 435-4183 in Massachusetts. Distributor and OEM inquiries invited.



**Dragon Industries**

**Turning Micro Computers into Monster Computers.**

### **Dragon Industries**

35 Main Street, Hopkinton, Mass. 01748

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Telephone \_\_\_\_\_

Computer \_\_\_\_\_

OS Version \_\_\_\_\_

Interested in: ☐ SP-65  
☐ SP-140





*Hayes. Leading the way  
with quality telecomputing  
systems for the personal  
computers that businesses  
use most.*

When it comes to communicating—computer to computer—Hayes says it best. All you need is a Hayes Smartmodem (it's like a telephone for your computer) and Smartcom II® software, to get you into all the right places.

In no time at all, and with no assistance at all, you can create, send and store files, and automatically log on to information services. The communication possibilities are endless!

---

***Introducing our new Smartcom II.  
More connection capabilities.  
More convenience.***

---

Now Hayes goes even further to streamline your communications and optimize your connections.

Smartcom II software is currently available for more than 16 personal computers (with even more to come). That means you can communicate,

Smartcom to Smartcom, with an IBM PC, DEC Rainbow 100, HP 150, TI Professional Computer\* and others.

And that's not all! Smartcom II also emulates the DEC VT100 and VT52 terminals, now in widespread use in many businesses. This feature lets your personal computer "pretend" it's a DEC terminal, opening the door to a vast installed base of DEC minicomputers!

---

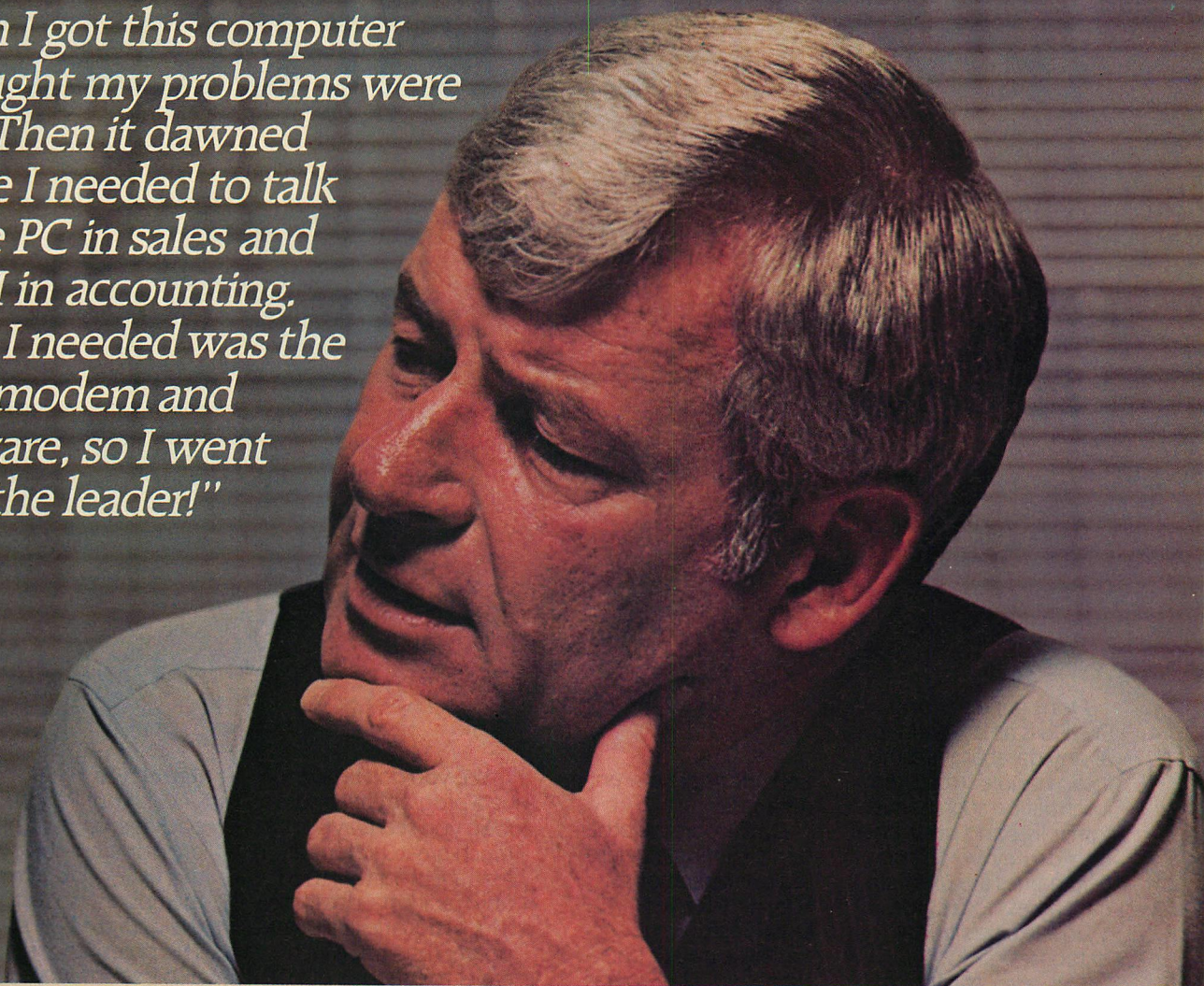
***We stand on protocol.***

---

In addition to the popular Hayes Verification protocol, the new Smartcom II also includes the XMODEM protocol, ensuring accurate transmission to a wide range of personal computers and mainframes at information services. By matching the protocol (or "language") of a remote computer to yours, Smartcom II can transmit information error-free, regardless of interference on the phone lines.



*"When I got this computer I thought my problems were over. Then it dawned on me I needed to talk to the PC in sales and the TI in accounting. What I needed was the right modem and software, so I went with the leader!"*



---

***Voice to data—in the same call***

With Smartcom II, you can easily switch from voice to data transmission (and back again), all in the same phone call. This saves you time and money, since you don't have to hang up and dial again.

---

***Your Hayes telecomputing system works—totally unattended.***

Smartcom II makes telecomputing simple, even when you're not there. It allows your Smartmodem to receive a message for you when you're out, and leave it on your disk or printer. And you can tell Smartcom II to "save" the messages you've created during the day, and automatically send them at night, when phone rates are lowest.

---

***Get your hands on the leader***

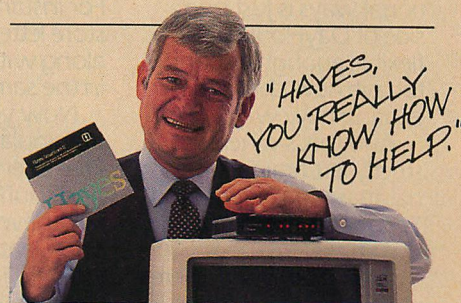
With an unsurpassed record of reliability, it's a small wonder Smartmodem

is such a smart buy! Smartmodem 300™ (the first of the Smartmodem series) dials, answers and disconnects calls automatically. Smartmodem 1200™ and Smartmodem 1200B™ (it plugs into an expansion slot inside an IBM PC or compatible), provide high-speed, high-performance communications for businesses of all sizes.

And when Smartmodem is purchased with Smartcom II, you have the most dependable telecomputing system available for your personal computer.

Everything we do at Hayes is designed to make communications easier for you. Feature-rich, direct-connect modems. Menu-driven software. Concise documentation. And a customer service organization, second to none!

See your dealer right now for a hands-on demonstration of Smartmodem and our latest version of Smartcom II. From the telecomputing leader. Hayes.



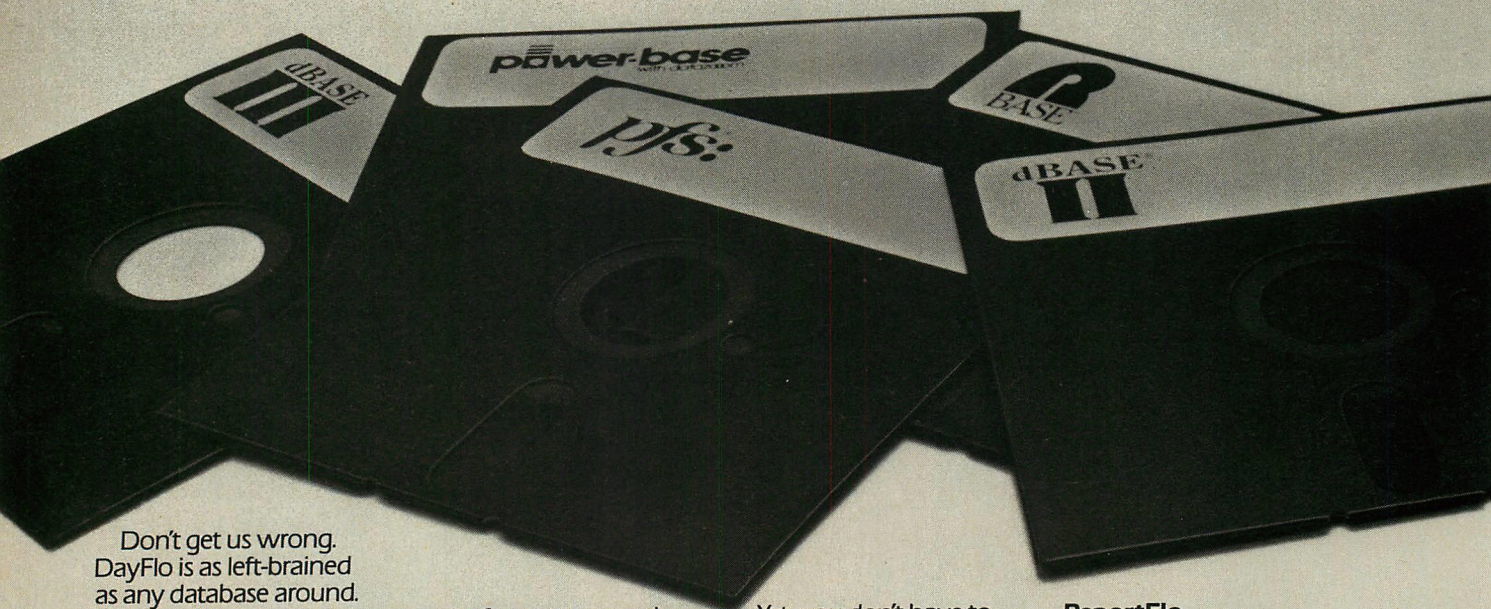
# Hayes™

**Hayes Microcomputer Products, Inc.**  
5923 Peachtree Industrial Blvd.  
Norcross, Georgia 30092 404/441-1617.

CIRCLE NO. 158 ON READER SERVICE CARD



# Traditionally, databases have been left-brained.



Don't get us wrong. DayFlo is as left-brained as any database around. It can handle structured information such as customer lists and personnel records. Keywords and field names are used to gain access to records.

Just like traditional databases.

However, solving traditional problems in traditional ways is just one side of DayFlo. It's also flexible enough to handle today's new challenges in exciting new ways.

And that's where strictly left-brained databases get left behind. **The First Free-Form Database.**

In the real world, there's always an exception to the rule.

Which wreaks havoc on traditional databases. For example, because of fixed formats, entering a new field such as a Telex number into a single customer record is next to impossible. Unless you're prepared to reprogram

and reformat your entire database.

DayFlo, on the other hand, eliminates these tedious operations.

## **Word-Oriented Database.**

Unlike traditional databases, DayFlo has integral word processing. For instance, you can store letters and memos along with customer lists in the same database.

Now you're free to manipulate data at will. Free to enter, retrieve, edit and shuffle information whenever and wherever you please.

Every fact you need, from key client lists to spontaneously entered notes and ideas, is just a few keystrokes away. **Power, Yes.**

## **Programming, No.**

DayFlo is a powerful package that runs on an IBM PC with hard disk, Compaq Plus, or compatibles.

Yet, you don't have to be a programmer to use it.

So you see, DayFlo is a much greater information management tool than any traditional database. Much more flexibility and power than pfs. Much easier to use than dBASE II.

## **ReportFlo.**

With our ReportFlo package, you can produce presentation-quality documents, reports, letters, memos and so forth from the data stored in DayFlo. This potent report writer also performs calculations.

### COMPARING DAYFLO TO TRADITIONAL DATABASES

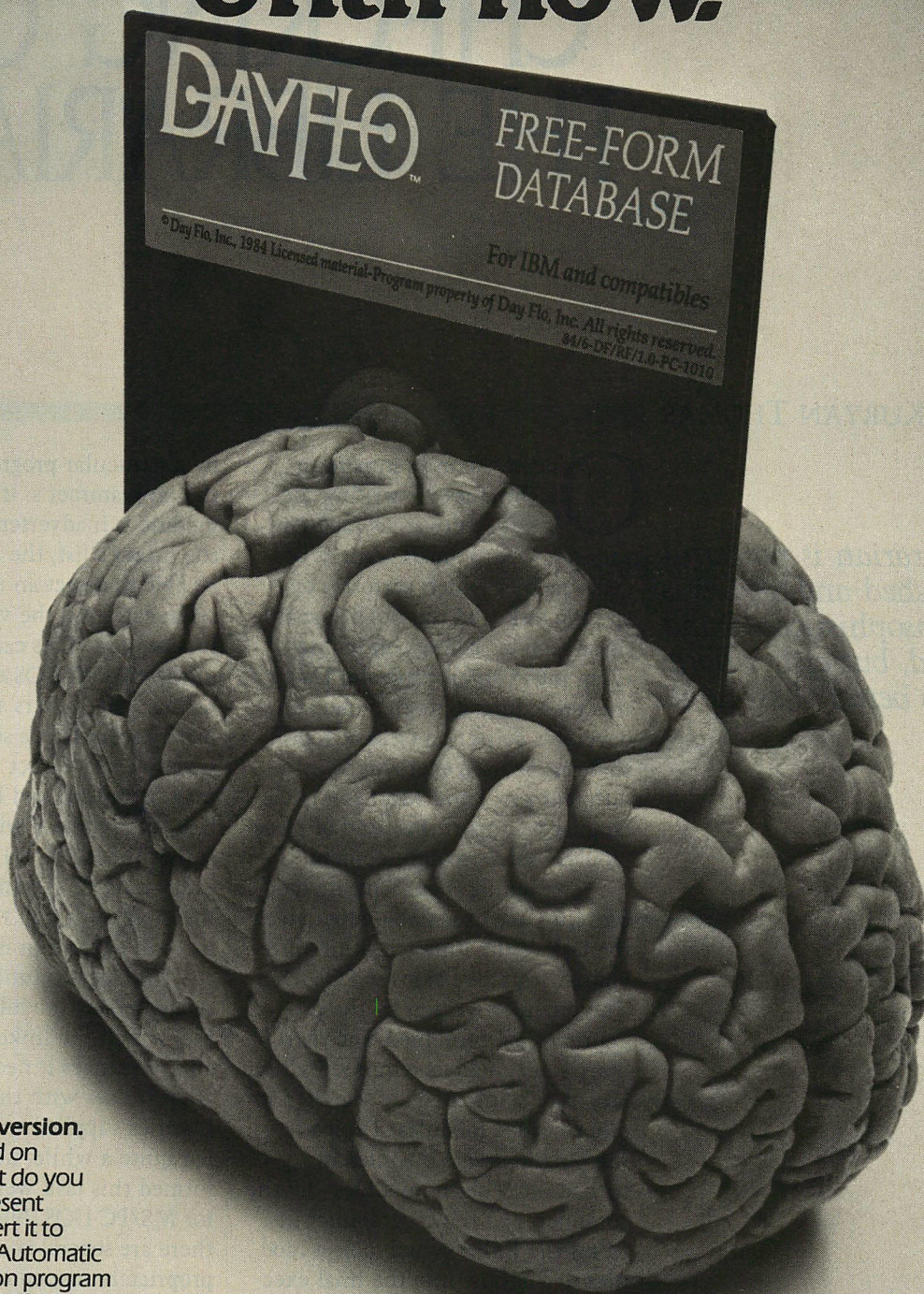
TRADITIONAL DBMS	THE BENEFITS OF DAYFLO
<ul style="list-style-type: none"><li>• Fixed record format. All records must look alike.</li><li>• No word processing capabilities.</li><li>• Fixed field length.</li><li>• Adding new fields requires remapping or reformatting of database.</li><li>• One value per field.</li><li>• Retrieves data based on pre-planned criteria only.</li></ul>	<ul style="list-style-type: none"><li>• Free-Form record format. No two records need look alike. All record formats are stored in same database.</li><li>• Integral word processing. Create and store letters, memos, notes, ideas, etc.</li><li>• Variable field length. No counting character spaces.</li><li>• Instantly add new fields to existing records without reformatting the entire database.</li><li>• Multiple values per field. Information where you want it.</li><li>• Retrieves information based on content or key words.</li></ul>

### WHAT YOU CAN DO WITH DAYFLO

<ul style="list-style-type: none"><li>• Client Record Tracking</li><li>• Sales Lead Tracking</li><li>• Personnel Records</li></ul>	<ul style="list-style-type: none"><li>• Letters, Memos, Reports</li><li>• Form Letters</li><li>• Note Taking</li><li>• Purchase Order Tracking</li></ul>	<ul style="list-style-type: none"><li>• Project Management</li><li>• Field Service Tracking</li><li>• And much more</li></ul>
--	--	---



# Until now.



#### **Automatic Conversion.**

OK, you're sold on DayFlo. But what do you do with your present database? Convert it to DayFlo. Use our Automatic Record Conversion program for your pfs or dBASE II data.

#### **Seeing Is Believing.**

Visit your nearest DayFlo Dealer and see DayFlo in action for yourself. Or, if you prefer, we'll send you a Demo Disk for \$10. For details, call 1-800-7DAYFLO. In California, call 1-800-CDAYFLO.

And please ask questions. Anything your brain, either side, can conjure up.

## DAYFLO™

# The right brain will love it.

DayFlo, Inc., 2500 Michelson Drive, Building 400, Irvine, CA 92715

CIRCLE NO. 217 ON READER SERVICE CARD



# CHECKING OUT THE LIBRARIANS

KURYAN THOMAS

*PolyLibrarian is powerful and polished and SR-LIB is unsophisticated and limited, but either librarian is better than none.*

One of the most important techniques for writing successful software is modularization—writing small sections of code, each of which performs one specific task, and thoroughly testing these sections before combining them into a single program. Using this procedure, a programmer can develop a collection of basic tools that can be used over and over by different programs. Most compiled languages support this kind of piece-by-piece software development.

Combining these separate modules into one executable program is the task of the linker, a utility provided with all versions of PC-DOS. The modules written by the programmer are combined, and then libraries of functions required by the language being used are searched for other needed modules. Typically, the programmer's modules are turned into "object modules" by the compiler, and the programmer informs the linker which object modules to combine into the final executable file. However, if the linker cannot locate a module needed by the program, it will generate an "UNRESOLVED EXTERNALS" error message, and the linker's output will not be able to be run.

The burden of keeping track of which object modules are required

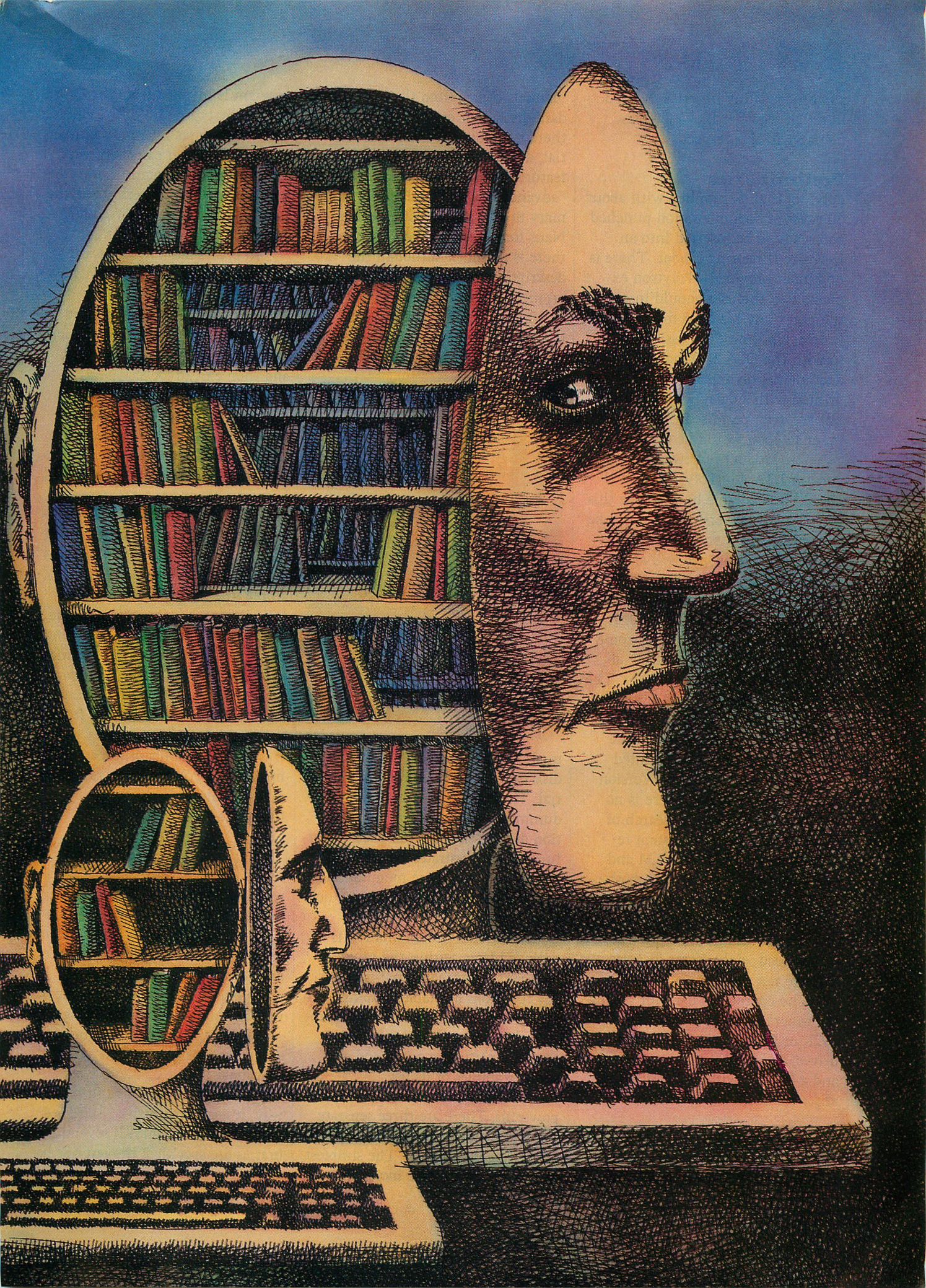
by a particular program is entirely the programmer's. If one object module is inadvertently left out of the linker's list, the linker will not be able to detect an unresolved reference until the very end of the link session. This can be frustrating in the MS/PC-DOS environment, because the linkers are quite slow. It may seem that a solution is to specify every object module that may be needed and hope for the best; the problem with that method is that the linker will combine every module specified into the run file, needed or not, thus increasing the size of the run file.

The ideal solution is to put all related object modules into a single file, which the linker can search for any references it needs—exactly what it does with the language libraries supplied with compilers. For quite a while, utilities that performed this task were not available for MS/PC-DOS. Now, however, there are several such products, appropriately named *librarians*, on the market. In this article, I will look at two of them, PolyLibrarian, from Polytron Corporation, and SR-LIB, from Software Research.

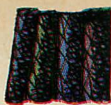
Although the primary purpose of a librarian is to make libraries of object modules, there are other tasks they can and should perform. They must also allow the programmer to replace modules in a particular library with updated versions and to

*Kuryan Thomas is a graduate student at Virginia Tech in Blacksburg, VA. His research involves digital image processing.*









examine existing libraries. A good librarian is rather like a database manager in this respect.

## Preliminaries

PolyLibrarian is supplied with about 60 pages of documentation punched and ready to be inserted into an IBM-size three-ring binder. There is no binder provided—Polytron explains that the user should insert the pages into his DOS manual. (Of course, it's almost impossible to do so with the DOS 2.10 manual.) The documentation appears to have been printed with a daisy wheel printer, but Polytron promised that the manuals soon would be typeset.

The product reviewed here is version 1.2A, but PolyLibrarian II should be available by the time this article appears (version 1.2A will be discontinued). A subset of PolyLibrarian II, version 1.3, will also be available. All versions require 128K of RAM and 70K of disk space, and all can run under PC-DOS 1.0, 1.1, 2.0, and 2.1. Either a monochrome or a color display can be used, although there is no use of color. The price for versions 1.2 and 1.3 is \$99; PolyLibrarian II is \$149.

SR-LIB is supplied with nine pages of documentation, printed with a dot-matrix printer. Version 1.03 is reviewed here; there is no mention by Software Research of any planned updates. System requirements are 64K of RAM and one disk drive. I ran it with both DOS 1.1 and 2.1 with no problems. SR-LIB's price is \$29.95.

Both programs are supplied on single-sided, eight-sector diskettes that are not copy protected.

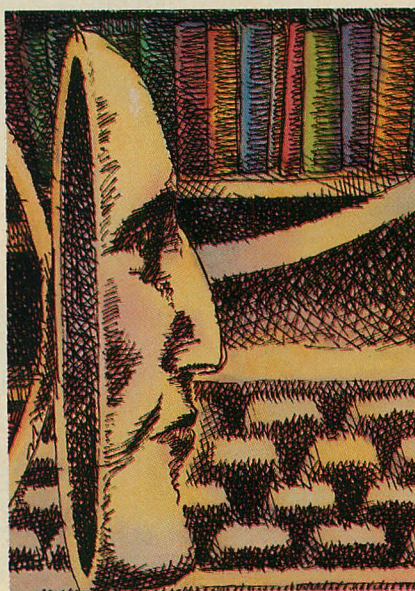
The computers used for testing the programs were an IBM PC with 192K of RAM, two single-sided drives, and a color graphics adapter and a PC/XT with 192K of RAM and a monochrome monitor.

## PolyLibrarian

PolyLibrarian's documentation is outstanding in a sea of mediocre

manuals. Apart from the now-standard disclaimer of any liability, there is a table of contents, a tutorial, detailed descriptions of all the features available, coverage of some "advanced topics," and a brief summary of all commands in Backus Naur format (BNF). Regrettably, there is no index, although the descriptions of the features are arranged alphabetically.

The tutorial provides a good introduction to the power of this program. There are several "object



modules" provided on the program disk that are to be used for the tutorial. These modules are merely dummies—they perform no function outside the tutorial. Each major function is illustrated by an example that uses these modules and that the user can key in and try out if he desires to do so.

Additional documentation is provided from within the program by a HELP command that lists all the functions available. Typing HELP <command name> will provide the user with a short description of a particular command and some examples of its use.

The program itself is extremely powerful. There are three separate ways to issue commands to it, all described in the manual. The simplest way is the *interactive mode*. The

program is invoked from the DOS prompt by typing in "LIB"; when it loads, it prompts for input with an asterisk. The user can then enter commands in a sequential way. After each function is performed, the asterisk returns. A QUIT command exits to the DOS prompt.

In *command-line mode*, the program invocation is followed by whatever commands the user wishes to be executed, separated by "-" symbols. The program will load, execute each command in order, and then exit to DOS.

The third mode is *command-file mode*. Here, the invocation command is followed by the name of a file that contains commands to be executed. These commands will be executed, and the program will return to the DOS prompt. In addition, all three modes can be mixed (this is one of the "advanced topics" discussed in the manual). For example, the program can execute some commands in command-line mode, then some from a command file, then go into interactive mode to accept commands directly from the keyboard, and, finally, it can execute some more commands from the original command line.

Table 1 is a list of the commands that PolyLibrarian recognizes. Qualifiers exist for some functions—for example,

## ADD name TO library NOASK RETAIN

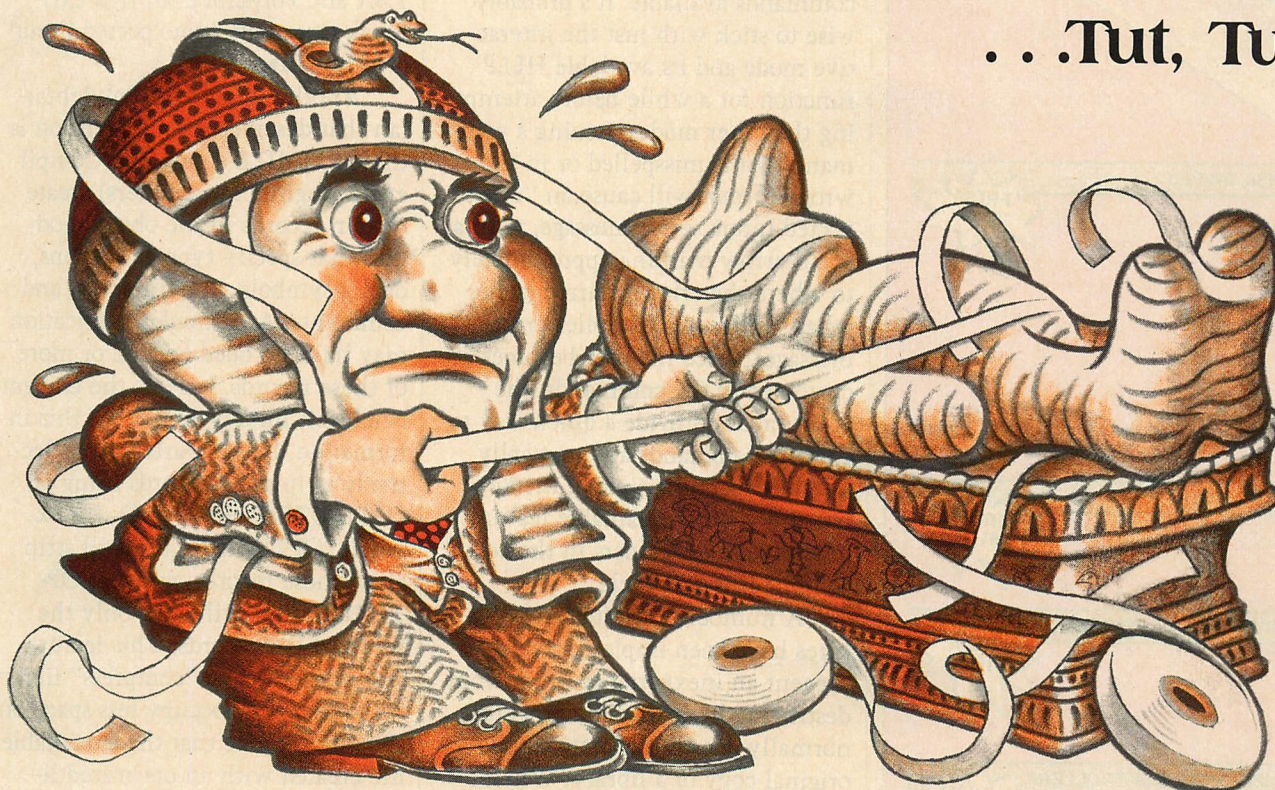
will add name.obj to library.lib, making it the default library (that is, automatically SELECTing it), and will retain the module name given by the compiler. If a module already exists with the same name, it will be deleted without ASKing.

These qualifiers can be in any order; there is a command parser that makes sense of them. Every time a library is specified in this way, it is automatically SELECTed as the current library. If several libraries are specified, the last one becomes the current library on exit.



# Considering Tape For Backup Storage?

...Tut, Tut.



There was a time when tape was the way to store backup data from your hard disk. It was fine for archives, but not when you wanted your data live and on-line. Today's business pharaoh can have his data on-line and backups, too—with 5 or 10 megabyte **removable cartridge** hard disk systems from **Micro-Design**.

Single-function tape backup units can't come close to matching the versatility and cost-effectiveness of hard disk cartridges; you get backup capabilities PLUS the benefit of having another full 5 or 10 megabytes of on-line data access.

Use hard disk cartridges the same way you use a floppy disk system. Just switch them out as needed—one cartridge for wordprocessing, another for accounting, and another for backup storage. Add additional cartridges whenever you like.



**Fast.** Cartridges run as fast, or faster, than fixed hard disk drives. A 5 megabyte backup takes only a few minutes, using Micro-Design's backup utility software. Switching out cartridges takes just a few seconds.

**Convenient and Secure.** It's easy to lock-up sensitive files—just remove the car-

tridge and put it somewhere safe. If you share a computer with others, everyone can have their own cartridge. Or, have a home cartridge and a business cartridge for use with your portable computer.

IBM® International Business Machines.

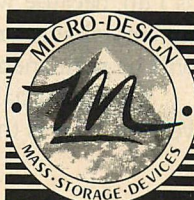
**Unlimited Expansion.** No more erasing old data to increase space on your hard disk. Fact is, there's no limit to the amount of off-line storage you can add.

Our **DATA Series** 5 and 10 megabyte cartridge hard disks are external drives available in removable only, or paired with 10, 20, or 33 megabyte fixed drives. Our **SQ Series** features 5 megabyte cartridge drives, in matching external cases or ready for internal installation. All are 100% compatible with the IBM-PC, XT, and work-alikes, with no software modifications needed. You can even boot from the hard disk.

Don't let single-function hard disk and tape units send your asp up the Nile. Ask your local computer dealer about Micro-Design's versatile hard disk cartridge units. Or, call us for details on our full product line and ordering information. Dealer inquiries invited.

We've got a complete line of mass storage devices, including floppy drives. Prices start as low as **\$1549** for a 20 megabyte fixed hard disk drive. Call for our **FREE** catalog today!

One year warranty. Network compatible. Backup utility software included with 2 drive systems.



## Micro-Design

Making The Most of Your Micro.

CIRCLE NO. 134 ON READER SERVICE CARD

Call Toll FREE 1-800-531-5002.

In Texas, call 512-441-7890.

6301 B Manchaca Rd., Austin, TX 78745



FOR  
XPRESS SERVICE,  
Toll Free 1-800-632-8515  
California 1-714-632-8512

**MICRO**  
**XPRESS**

Special Xpress

64K RAM CHIPS ..... \$52  
(Set of 9) 150 NS

64K RAM CHIPS ..... \$49  
(Set of 9) 200 NS

#### DISK DRIVES

For your IBM PC or compatible.

##### 5 1/4" FULL AND HALF HEIGHT DISK DRIVES

TANDON TM 100-2  
TANDON TM 101-4  
CONTROL DATA 9409  
TANDON 50-2  
CONTROL DATA 9428  
QUME 142-A  
TEAC 55B  
TEAC 55F  
AMDEK AMDISK-V

FROM  
\$130

#### MONITORS

AMDEK VIDEO 310-A  
PGS HX-12  
PGS SR-12

FROM  
\$175

#### HARD DISK SUBSYSTEMS

I<sup>2</sup> INTERFACE  
10, 15, 21 & 33MB  
MAYNARD  
WS1, 2, & 3

FROM  
\$1070

#### DISK DRIVE CONTROLLERS

##### MAYNARD

All options available.

FDC (5 1/4")  
FDC (8")

##### MAYNARD

Sandstar Series  
Modular Controller Cards ..... Call

FROM  
\$160

#### SOFTWARE UTILITIES

##### TALL TREE

J FORMAT-2, WINDRIVE,  
JETDRIVE ..... Each \$40

#### EXPANSION BOARDS

##### AST RESEARCH

All options available.  
Expandable memory.  
SIX PAK PLUS (64K)  
MEGA PLUS II (64K)  
I/O PLUS II

##### QUADRAM

All options available. Expandable memory.  
QUADBOARD  
EXPANDED QUADBOARD  
QUADBOARD II

FROM  
\$130

#### COLOR/GRAPHICS CARDS

##### HERCULES

PARADISE SYSTEMS  
AST MONOGRAPH PLUS

FROM  
\$250

Hours: 8 AM - 5 PM Mon.-Fri.

Toll Free 1-800-632-8515  
California 1-714-632-8512

TERMS: Prepayment, COD, Visa and MasterCard  
accepted. Add 2% shipping and handling on all orders.  
Add 3% surcharge for Visa and MasterCard.  
Prices subject to change without notice. 20% re-  
stocking charge for all returned items.



## LIBRARIANS

All commands (except KILL) can be specified by typing in their first one or two characters.

There is quite a repertoire of commands available. It's probably wise to stick with just the interactive mode and its available HELP function for a while before attempting the other modes. Issuing a command that is misspelled or in the wrong format will cause an "unexpected input" error message, with a small arrow pointing approximately to where the error occurred (somewhat similar to a compiler error message). Once the user becomes accustomed to the commands, the other modes provide a quick way to execute commands automatically without spending time at the keyboard, which is a valuable feature for software developers in the edit-compile-link-test cycle.

A number of useful safety features have been implemented to prevent an inexperienced user from destroying libraries. The program normally does not operate on the original copy of a library. When a library is SELECTed (either directly by use of the SELECT command or indirectly by some other command), a back-up copy is made on the default disk (the WORK command allows another drive to be specified for this purpose). All operations are performed on this copy. Thus, if something goes wrong, the original library is still available. If the user inadvertently issues a command he didn't intend to, he can recover by typing KILL. This wipes out the working copy, leaving the original library. The UPDATE and QUIT commands make the (altered) back-up copy into the actual library. The original library is not saved. This back-up feature can be disabled by issuing a BACKUP NO command. Polytron strongly discourages this, as I do, because without the back-up, any changes made to the library will be permanent.

One potential problem with version 1.2A is that it will respond

to a Ctrl-Break by exiting immediately to DOS, without updating the current library. Even that problem has been taken care of with version 1.3A and PolyLibrarian II; a Ctrl-Break causes an "unexpected input" error message.

Another feature of PolyLibrarian that deserves special mention is the OPTIMIZE command. Compilers (though not assemblers) create certain records in the object modules that specify type definitions, debug symbols, line numbers, and comments. A particular application may have no need for one or more of these records. Indeed, the current Microsoft linkers do not use this information. PolyLibrarian can selectively strip these records using an OPTIMIZE COMMAND. For example, OPTIMIZE 1111 will strip all of these records, whereas OPTIMIZE 1001 will strip only the first and last records. This feature allows the user to "compress" libraries so that they occupy less space on the disk. Notice that the executable file created with an optimized library will not be any smaller.

Programmers who own one of the new Microsoft compilers (Pascal 3.2 and FORTRAN 3.2) know that the libraries provided with them are radically different from previous versions. The supplied linker must be used, because the PC-DOS linker cannot read these libraries. This accounts for the major difference between PolyLibrarian versions 1.2A and 1.3. Version 1.2A could not read the new libraries, which prevented curious users from examining them. Version 1.3 corrects this by adding a MODE command that allows the user to specify, among other things, whether the library is to be Microsoft 3.2- or 3.1x-compatible. PolyLibrarian II goes one step further and supports the Intel library format, even allowing Intel modules to be added to Microsoft libraries and vice versa. I was not able to test this feature because I don't own an Intel compiler.



# Capable COBOL.

For over twenty years, COBOL has proved it can handle the most awesome data handling requirements of the business world.

And Microsoft® COBOL brings this power to the MS™-DOS environment in an even more flexible version. It's the ideal choice for transporting and adapting the thousands of mainframe and minicomputer programs now on the market.

Microsoft COBOL was designed after the ANSI COBOL standard. Its quality and performance has been fully certified by the GSA.

Microsoft COBOL includes a complete set of file handling facilities including support for sequential, line sequential, relative and B+ tree indexed sequential (ISAM) files.

The advanced screen handling features, compatible with Data General®, make it easy to create forms and menus for interactive user programs. Direct cursor positioning, highlighting, automatic format conversion, projected

fields, and automatic field skip are just some of the capabilities.

An interactive source code debugging tool allows you to step through your program in symbolic form. There is no need to wade through object code and addresses in memory to see what is going on. It's a complete development package.

Applications developed with the compiler can be distributed without a runtime support charge.

Like all Microsoft languages, the standard linking interface makes it easy to combine assembly language subroutines.

**Call 800-426-9400 to order the capable COBOL. \$700\***

In Washington State, call 206-828-8088. Ask for operator I6, who will rush you your order, send you more information, or give you the name of your nearest dealer to see Microsoft COBOL in action.



\*Price exclusive of handling and Washington State sales tax.  
Microsoft is a registered trademark and MS is a trademark of Microsoft Corporation.  
Data General is a registered trademark of Data General Corporation.



# C

## Software Development PCDOS/MSDOS

### Complete C Compiler

- Full C per K&R
- Inline 8087 or Assembler Floating Point, Auto Select of 8087
- Full 1Mb Addressing for Code or Data
- Transcendental Functions
- ROMable Code
- Register Variables
- Supports Inline Assembler Code

### MSDOS 1.1/2.0 Library Support

- All functions from K&R
- All DOS 2.0 Functions
- Auto Select of 1.1 or 2.0
- Program Chaining Using Exec
- Environment Available to Main

### c-window™ Symbolic Debugger

- Source Code Display
- Variable Display & Alteration Using C Expressions
- Automatic Commands
- Multiple Breakpoints by Function & Line Number

### 8088/8086 Assembler

- FAST — Up to 4 times Faster than IBM Assembler
- Standard Intel Mnemonics
- Compatible with MSDOS Linker
- Supports Full Memory Model

### 8088 Software Development Package

**\$199<sup>00</sup>**

Includes: C Compiler/Library, c-window, and Assembler, plus Source Code for c-systems Print Utility

**c-systems**

P.O. Box 3253  
Fullerton, CA 92634  
714-637-5362



## LIBRARIANS

Version 1.3's MODE command also allows date- and time-stamping of each entry in a library for archival purposes. These stamps are derived from the DOS clock.

Version 1.3 and PolyLibrarian II support full DOS 2.xx path names for every function that requires them. They all seemed to function smoothly. Version 1.2A has no DOS 2.xx support. My pre-release version of PolyLibrarian II can be run only under DOS 2.xx, but Polytron claims that its shipped version can be run under earlier versions of DOS as well (without any path-name support, of course).

### SR-LIB

This small librarian is considerably more limited than PolyLibrarian. Only two operations are supported: adding and deleting modules from a library. Nine pages of documentation may seem rather few, and those pages are unattractively put together, but they do a good job of explaining how to use the program. There is no tutorial, but keep in mind that with only the two basic functions of a librarian supported, there is little need for one.

An example showing how to specify commands to the program is provided in the SR-LIB manual. It also includes a list of error messages, which are two-letter acronyms—for example, "im" signifies "invalid module." The brief introduction explains the benefits of using libraries and provides some interesting information—for example, it states that PC-DOS libraries have enhanced indices over Intel libraries.

The operation of SR-LIB is similar to, though not quite as flexible as, PolyLibrarian's interactive mode. When the program is invoked from DOS by typing in SRLIB, three successive prompts for input are displayed. The first asks for a library name to work with. The second asks for a list of commands, and the third asks whether a listing of the specified library is required. If a li-

brary that does not exist is specified on the first prompt, the program will ask whether a new library should be created. Pressing "y" will create a new library; pressing anything else will halt the program. After the commands entered at the second prompt are executed, a listing will be generated on the screen (if CON was typed in response to the second prompt) or on the printer (if PRN was typed). The program then exits to DOS. Unlike PolyLibrarian, SR-LIB cannot work on more than one library in one session. The program for each library must be invoked.

The operations are entered in response to the second prompt as a sequence of object module names separated by a plus sign or a minus sign. A plus sign means "add the following object module to the library," and a minus sign signifies deletion. There is no way to explicitly replace a module—it must be deleted and then replaced.

Any of the prompts can be answered with a null entry simply by pressing ENTER without any input (even the library name prompt). To get a listing of a library without doing anything to it, the user can give a null response to the operations prompt and indicate the desired output device at the listing prompt. (A null response to the listing prompt will prevent a listing from being produced.) The listing does not include any information on public and external symbols, and it cannot be sent to a disk file.

No optimization can be specified. I examined some libraries created by SR-LIB using PolyLibrarian and discovered that the optimization levels were all 0000, meaning that no optimization was done.

Neither DOS 2.xx path names nor the new Microsoft library format is supported by SR-LIB.

### Complaints and Bugs

I have a small complaint about the explanation of command-line mode



# Potent Pascal.

Microsoft® Pascal may be the most powerful software development environment available for the MS™ DOS system. It combines the programming advantages of a structured high-level language with the fast execution speed of native code compilation.

And it exceeds the proposed ISO and ANSI standards with logical extensions that make the language more powerful and versatile. For example, programming capabilities even allow you to manipulate data at the system and machine level.

It gives you single and double precision IEEE floating point arithmetic. Numeric operations take advantage of the 8087. Or automatic software emulation is

provided if the coprocessor is not installed.

Support for long heap allocation and separate module compilation gives you the flexibility to create large programs up to one megabyte.

And the standard linking interface makes it easy to combine Microsoft FORTRAN or assembly language subroutines.

**Call 800-426-9400 to order the potent Pascal. \$300\***

In Washington State, call 206-828-8088. Ask for operator C5, who will rush you your order, send you more information, or give you the name of your nearest dealer to see Microsoft Pascal in action.

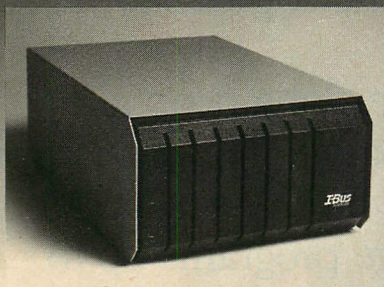
A hand is shown from the bottom right, holding a large, dark, three-dimensional block letter logo that reads "MICROSOFT". The letters are thick and have a slightly weathered or metallic appearance. The hand is positioned as if presenting the logo.

\*Price exclusive of handling and Washington State sales tax.

Microsoft is a registered trademark and MS is a trademark of Microsoft Corporation.



# SQUEEZED FOR SLOTS?



- ☐ Six expansion slots plus power supply
- ☐ Brings system total to ten slots
- ☐ No special addressing, part of PC I/O bus
- ☐ Compatible with all PC expansion cards
- ☐ No noise—no fan

An expansion chassis is a must for anyone who needs to go behind the PC's minimum configuration. Simply plug the I-Bus Six-Pac Expansion Chassis into one slot of your PC—and you've doubled your expansion slots from five to a total of ten. There's no special addressing or software required. Cards plugged into the Six-Pac perform exactly as if they were in the main system unit.

And there's plenty of power, too, because chances are your PC will run out of power before it runs out of slots. The Six-Pac's 40W supply quietly powers its own slots, with negligible power drawn from the PC.

It's only \$795, including 18" shielded interface cable (or \$835 with a four-foot cable). Call us today for all the details.

Call toll free:

**(800) 382-4229**

in California call (619) 569-0646

## The I-Bus Six-Pac Expansion Chassis

**I-BUS**  
SYSTEMS

9235 Chesapeake Drive  
San Diego, CA 92123



## LIBRARIANS

COMMAND	FUNCTION	COMMENTS
<b>LIB</b>	Invokes the program from DOS	Can be followed by additional commands
<b>ADD</b>	Adds a module	Can be used with additional qualifiers
<b>BACKUP</b>	Displays or changes current back-up status	Turning it off is not recommended
<b>CASE</b>	Specifies whether names should be case-sensitive	
<b>CHANGE</b>	Changes a module or public name	
<b>DATE</b>	Specifies whether modules should be date-stamped	Archival information
<b>DELETE</b>	Removes a module	
<b>DIR</b>	Directory	Same as DOS DIR/W. Supports wildcards
<b>EXTRACT</b>	Makes an object module from a library module	Can be used with NDASK
<b>FIND</b>	Finds a public name or external	Only 1.3 or II
<b>HELP</b>	Provides help	Can be followed by a specific command name for help on that function
<b>INTERACTIVE</b>	Enters interactive mode	Only useful in command line or command file modes
<b>KILL</b>	Discards changes since last UPDATE	
<b>LIST</b>	Lists all modules	Optionally, publics and externals. Cannot be sent directly to printer, but can be sent to a file.
<b>MAKE MODE</b>	Creates a new library Sets defaults for TYPE, RETAIN, DATE, and OPTIMIZE	Can be used with NOASK Only in 1.3 and II
<b>OPTIMIZES</b>	Compresses libraries	Selective compression is possible
<b>QUIT</b>	Exits current mode	Automatically UPDATES
<b>REPLACE</b>	Replaces a module with another	
<b>SELECT TYPE</b>	Selects the working library Specifies which kind of library (old or new Microsoft format)	Only 1.3 and II
<b>UPDATE WORK</b>	Makes changes permanent Specifies which drive to use for back-up copy	

**Table 1: PolyLibrarian Functions**

in PolyLibrarian. The manual for version 1.2A explains that commands should be separated by slashes or minus signs. However, it is not explicitly stated that a space must precede these separators. Polytron intends to clarify this in its new documentation.

SR-LIB could not read the new Microsoft libraries, but instead of giving an "im" (invalid module) error and stopping, it gave the message and froze the system, requiring a reboot. I should note here that SR-LIB will make libraries that the new

Microsoft linker can read—the language libraries that are supplied with the compilers are what the linker is unable to read.

Some error messages produced by SR-LIB are not described in the manual. For example, giving a null response to the library name prompt will cause the program to ask if the user wants to create a new library. If the user replies "yes," the program reports "creation error." These errors are self-explanatory, but they should still be listed with the two-letter messages in the manual.



# Ferocious FORTRAN.

Microsoft® FORTRAN crunches numbers with a vengeance!

It combines fast and efficient native code compilation with built-in 8087 coprocessor support. The result? Mini and mainframe performance from your MS™ DOS micro.

Based on the '77 standard, Microsoft FORTRAN supports extensive statements and data types—including complex numbers and IEEE single and double-precision floating point accuracy.

Support for large arrays (greater than 64K bytes), separate module compilation, and overlays, allow you to create very large programs—up to one megabyte, with access to more than 65 thousand records in a file as large as four gigabytes.

How do programmers feel about Microsoft FORTRAN?

“The first FORTRAN compiler

that takes advantage of the full addressing capability of the 8088 and the power of the 8087.”

—Jack Wilschke, *Softalk*

“We decided to use the Microsoft FORTRAN Compiler for its INTEGER 4 capability and the flexibility of its 8087 implementation.”

—Charlie Huizena &  
Chip Barnaky, *PC World*

**Call 800-426-9400 to order  
the ferocious FORTRAN.  
\$350\***

In Washington State, call 206-828-8088. Ask for operator C4, who will rush you your order, send you more information, or give you the name of your nearest dealer to see Microsoft FORTRAN in action.



\*Price exclusive of handling and Washington State sales tax.  
Microsoft is a registered trademark and MS is a trademark of Microsoft Corporation.





## LIBRARIANS

### Comparing the Librarians

Comparing these two markedly different programs is a bit like (if you'll pardon the puns) comparing the Library of Congress to the public library in my small town. The Library of Congress contains many millions of books, making it hard to find any particular book; my public library has only a few thousand books, so it is possible to look over all of them in one weekend.

In much the same way, PolyLibrarian is an extremely powerful software development tool, but it may take the user 45 minutes with the tutorial and three weeks of use before he is familiar with all the features. In contrast, it takes about 15 minutes to learn to use SR-LIB to its full (but limited) capacity. SR-LIB performs the basic functions required of a librarian, provided it doesn't have to work with the new Microsoft compilers' libraries.

***It is no small feat for a microcomputer program that costs \$99 (\$149 for II) to hold its own against a supermini program that costs many thousands or tens of thousands of dollars. PolyLibrarian is one software product that can't be outgrown.***

People who often work with large numbers of object modules need PolyLibrarian. It can contain approximately 8,000 modules in one library and an unlimited number of public and external symbols in each module (this information is from the manual—I haven't the stomach to try it out!).


SR-LIB has a limit of 500 modules and 1,024 public symbols. The limitation on the number of modules isn't serious, but more than 1,024 public symbols can be created

easily in a large library of scientific subroutines (in FORTRAN, for example, each COMMON block name is a public variable).

### Which One Is Better?

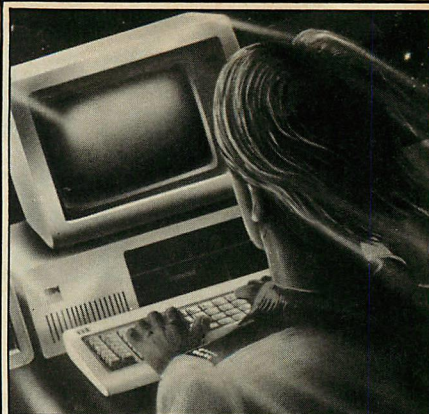
For serious programming, a librarian should be considered as important as a compiler. Even an unsophisticated librarian is better than none. I can thus recommend SR-LIB, especially considering its low price, for programmers whose programming needs are not large and who have a limited budget for software tools. SR-LIB does the basic job well.

PolyLibrarian is a powerful and polished product. Before becoming involved with micros, I worked with superminicomputers, such as the DEC VAX 11/780. These machines are usually supplied with powerful software development tools. However, PolyLibrarian is superior in some respects to the VMS librarian supplied with the VAX. Not only is PolyLibrarian easier to use but it also has features missing in the VMS Librarian, such as extensive archival capabilities.

It is no small feat for a microcomputer program that costs \$99 (\$149 for II) to hold its own against a supermini program that costs many thousands or tens of thousands of dollars. Polytron deserves credit for this outstanding product. PolyLibrarian is one software product that can't be outgrown. 

**PolyLibrarian**  
Polytron Corporation  
P.O. Box 787  
Hillsboro, OR 97123  
503-648-8595  
Version 1.2A—\$99.00  
PolyLibrarian II—\$149.00  
CIRCLE 496 ON READER SERVICE CARD

**SR-LIB**  
Software Research  
P.O. Box 10004  
Austin, TX 78766  
\$29.95  
CIRCLE 497 ON READER SERVICE CARD



**Imagine your PC with Apparatus add-ons. Imagine where it could take you.**

**Special values from the hard disk experts.** For example, imagine your IBM PC or Portable PC with hard disk capability. Apparatus's external Hard Disk Subsystem is completely compatible, running DOS 2.0 or 2.1 without modification or device drivers. And now you can get more capacity—22 and 33 MB formatted configurations—for less money. 22 MB for **\$2,295**, 33 MB for **\$2,995**. Apparatus also offers internal or external 10 MB drives at similarly low prices.

**XT owners—trade in your 10 MB drive for a larger Apparatus hard disk drive.** Our 22 MB drive is **\$1,299**, but you pay just **\$899** with a trade-in of your existing 10 MB drive. Our 33 MB drive is just **\$1,799**, but you pay just **\$1,399** when you trade in your existing 10 MB drive. Call the Apparatus ordering hotline for trade-in details and shipping instructions.

**TEAC or Panasonic floppies.** These half-height floppies are perfect for your PC, PPC, or XT. Call for trade-in prices on full-height floppies.

**New 28 pin EPROM programmer.** Now Apparatus has a new Prom Blaster for the PC, XT, PPC and PCjr to program most 28 pin EPROMs (including the 2764, 128, 256), in addition to our original Prom Blaster that programs most 24 pin EPROMs...each **\$129**. We also make an EPROM cartridge for the PCjr to accept your newly programmed EPROMs.

**PPC and PCjr.** Apparatus has developed new products for the IBM Portable PC. Now available is a 256K RAM card and a Combo card (P & S). Both fit the PPC short slots. New for the PCjr is a 128K RAM card and a Combo jr card (P & clk). Both fit the side attachment.

**Other Apparatus add-ons.** RAM cards for the PC and XT—64K **\$189**, expandable to 512K. COMBO II card for the PC and XT, 5 functions on one card—**\$189**. CRAMBO card for the PC piggybacks COMBO II on 64K RAM card—**\$359**. 64K internal PRINT SPOOLER with parallel interface—**\$299**. Stand-alone at **\$319**.

**Warranty.** All Apparatus manufactured P.C. boards sold after June 1, 1984 covered by our exclusive lifetime limited warranty covering parts and labor.

 **Apparatus, Inc.**  
ADD ON AND ON AND ON AND ON AND ON

ORDERING AND DEALER  
INFORMATION  
**800/525-7674**

Prices subject to change without notice.



An artistic illustration of a person with long hair, seen from behind, sitting at a desk and typing on a keyboard. The computer system includes a CRT monitor, a system unit, and a separate floppy disk drive. The background is a deep space scene with a large, glowing blue and orange nebula, a satellite dish floating in the upper left, and a bright star in the upper right. The word "APPARAT" is written in large, white, serif capital letters across the middle of the image.

# APPARAT

**APPARAT TAKES YOUR PC TO NEW REALMS.**

4401 South Tamarac Parkway, Denver, CO 80237—Customer Service 303/741-1778  
Apparat retail outlets—DENVER: 4401 S. Tamarac Pkwy. 303/771-2032 • 5224 W. Warren Ave. 303/985-1217  
CHICAGO: 1844 S. Arlington Heights Rd. 312/640-0322

CIRCLE NO. 106 ON READER SERVICE CARD



# Join the network

Develop a program for the new IBM  
PC Network.

Promote yourself into the top ranks of network programmers. Write new programs or modify existing ones to run on the local area network that's sure to be a best seller.

Capitalize on a chance to be in from the beginning with integrated business applications, productivity tools and office automation programs.

A high-level interface card makes programming for the IBM PC Network fast and easy. Full data sharing and byte locking capability, multiple servers, two megabits per second data transmission and a complete diagnostic package make the network equally as attractive to the end user.

For complete details about joining the network call 1-800-426-2700. Or write IBM Corporation, Editor, IBM Personal Computer Seminar Proceedings, 5Q9/4629, P.O. Box 1328 Boca Raton, FL 33432.

CIRCLE NO. 135 ON READER SERVICE CARD



Little Tramp character licensed by Bubbles Inc., s.a.



# IBM PC Network Specifications

## IBM PC NETWORK ADAPTER

### **HARDWARE HIGHLIGHTS**

#### **MICROPROCESSORS**

- 6MHz 80188
- 6MHz 82586

#### **MEMORY**

- 32K PROTOCOL ROM
- 16K RAM
- 8K NET BIOS ROM

#### **VIDEO COMPATIBLE RF MODEM**

- TRANSMIT 50.75 MHz (CH T14)
- RECEIVE 219 MHz (CH J)
- SUPPORTS 1000 NODES
- MAXIMUM DISTANCE 5KM RADIUS FROM HEADEND
- MULTIPLE SERVICES POSSIBLE

#### **DIAGNOSTICS**

- POWER-ON SELF-TEST
- ON-LINE MEDIA MONITORING

#### **OTHER**

- SUPPORTS DMA DATA TRANSFERS
- 2-MEGABIT/SECOND DATA RATE
- MID-SPLIT BROADBAND

### **FIRMWARE HIGHLIGHTS**

#### **OPEN ARCHITECTURE**

- PEER-TO-PEER NETWORK
- OPERATING SYSTEM INDEPENDENT
- LOCALNET/PC™, PUBLISHED LAYERED PROTOCOL

#### **FUNCTIONS**

- BASE FUNCTIONS PROCESSED ON THE ADAPTER, NOT THE PC
- DISTRIBUTED NAME SUPPORT
- REMOTE PROGRAM LOAD
- 32 CONCURRENT TWO-WAY SESSIONS
- HIGH THROUGHPUT RATE AT SESSION LAYER
- CHARACTER SET INDEPENDENT

## IBM PC NETWORK CABLING SYSTEM

### **IBM PC NETWORK TRANSLATOR UNIT**

#### **HARDWARE HIGHLIGHTS**

- SINGLE RF CHANNEL CONVERSION
- ATTACHMENT OF UP TO 72 PCs WITH IBM CABLING
- ATTACHMENT OF UP TO 256 PCs WITH CUSTOM CABLING
- DATA ONLY
- ALLOWS NODES WITHIN A 1000-FOOT RADIUS

#### **CABLE**

##### **TYPE**

- STANDARD CATV MEDIA (75 OHM COAX)
- TREE TOPOLOGY
- CATV STANDARD F-CONNECTORS
- PREBALANCED BROADBAND NETWORK

#### **KITS**

- BASE EXPANDER (ALLOWS EXPANSION FROM TRANSLATOR)
- SHORT-DISTANCE KIT (1 FOOT ADDITIONAL CABLE)
- MEDIUM-DISTANCE KIT (400 FEET ADDITIONAL CABLE REQUIRED)
- LONG-DISTANCE KIT (800 FEET ADDITIONAL CABLE REQUIRED)
- CABLE AVAILABLE IN 4 LENGTHS: 25 FT., 50 FT., 100 FT., AND 200 FT.

#### **MAXIMUM PCs AND DISTANCES SUPPORT**

	<b>RADIUS FROM TRANSLATOR</b>	<b>PCS</b>
• TRANSLATOR ONLY	200 FEET	8
• 8 SHORT-DISTANCE KITS	200 FEET	72
• 8 MEDIUM-DISTANCE KITS	600 FEET	72
• 8 LONG-DISTANCE KITS	1,000 FEET	72
• 8-KIT COMBINATION	200 to 1,000 FEET	72

## IBM PC NETWORK SOFTWARE

### **DOS 3.1**

#### **EXPANDED SUPPORT FOR NETWORKING**

- FILE SHARING
- RECORD LOCKING DOWN TO BYTE LOCKING

#### **PROGRAM INTERFACE TO NETWORK SOFTWARE**

- REDIRECTION CONTROL
- INSTALLATION CHECKING
- DIRECT EXECUTION OF NET BIOS FUNCTIONS
- MULTIPLE SERVERS

#### **IBM PC NETWORK PROGRAM**

##### **FULL SCREEN INTERFACE AVAILABLE**

##### **REDIRECTOR**

- ALLOWS USE OF SHARED PRINTERS
- ALLOWS USE OF SHARED DISKS AND DIRECTORIES
- PROVIDES CAPABILITY TO SEND MESSAGES

##### **FILE SERVERS**

- SHARED USE OF NAMED DISKS OR SUBDIRECTORIES
- PASSWORD PROTECTION AGAINST UNAUTHORIZED ACCESS
- VARIETY OF ACCESS MODES SUPPORTED (E.G. READ ONLY)
- RECORD LOCKING TO CONTROL MULTIPLE UPDATES

##### **PRINT SERVER**

- SHARED USE OF NAMED PRINTERS
- PASSWORD PROTECTION AGAINST UNAUTHORIZED ACCESS
- AUTOMATIC SPOOLING AND QUEUING OF OUTPUT
- QUEUE MANAGEMENT FACILITIES ON SERVER STATION

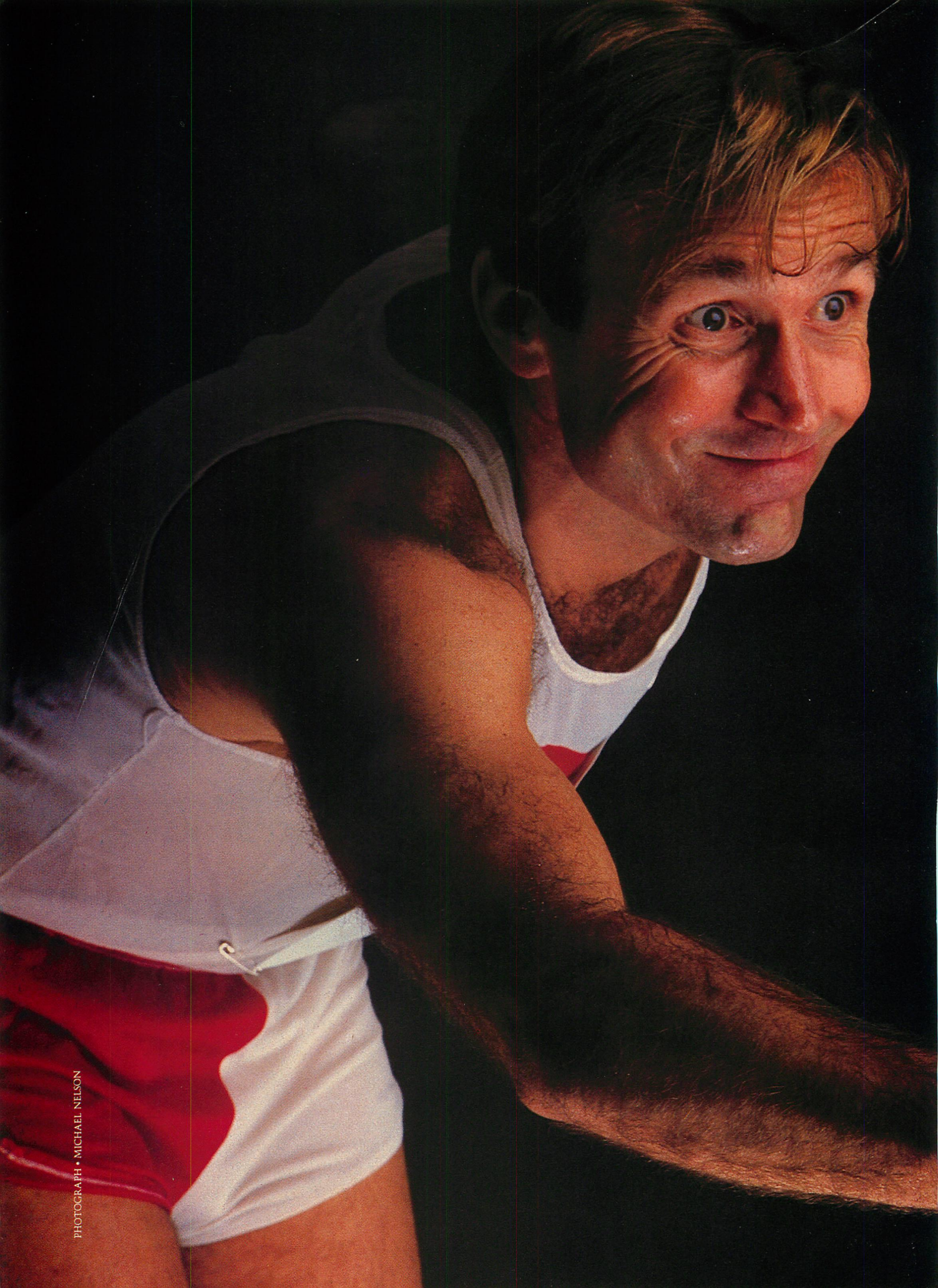
##### **MESSAGE SERVER**

- INTERACTIVE MESSAGE EDITING/TRANSMISSION/RECEPTION
- PRESERVES FOREGROUND APPLICATION CONTEXT
- AUTOMATIC NOTIFICATION OR LOGGING TO DISK/PRINTER

LOCALNET/PC IS A REGISTERED TRADEMARK OF SYTEK, INC.









# INSTANT RELAY

*Beat the clock with this feature-packed communications package.*

AUGIE HANSEN

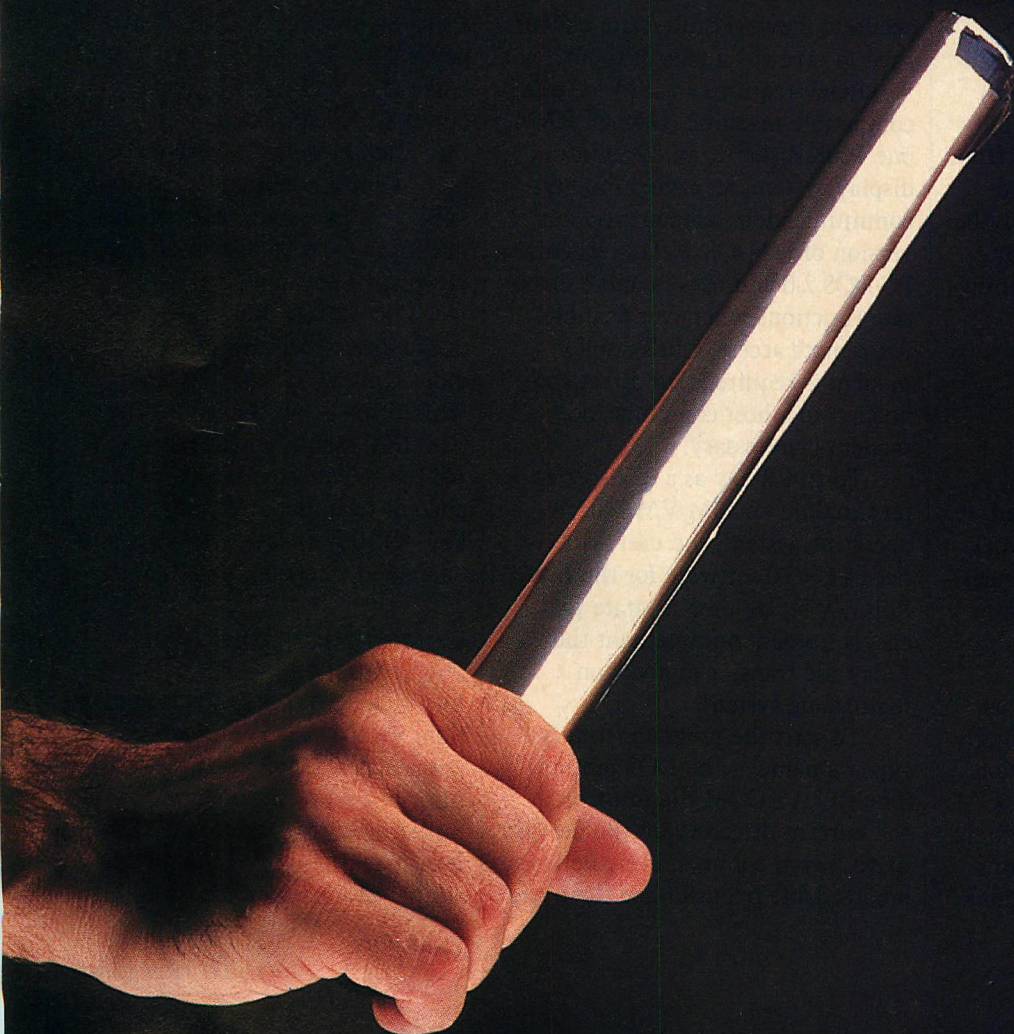
The deadline for a new product delivery approaches, and programmers on both coasts are hard at work on some last-minute additions. In the wee hours of the morning an interesting exchange takes place between two programmers, each typing feverishly in an attempt to beat the clock, as they have done so many times before.

"I put the mods you asked for into the disk fixer program. Do want to look 'em over?"

"Yeah—just send me the three modules for the sector modification mode. The rest of it looked OK to me last time. I'm printing out the updated spec sheets as we speak."

---

*Augie Hansen is a programmer for a major telecommunications company and a contributing editor to this magazine.*





"OK. They'll be on their way as soon as the file you're sending me is done. After I start the transfer I'm going to do some editing on the user guide. I'll check back when the transmission's complete. Beep if you need anything else."

A PC-to-PC "conversation," error-free file transfers, printing, and editing all going on simultaneously. At least it seems that way. Is this possible? What miracle of modern technology is at work here?

It's Relay, a powerful communications program for the IBM PC by VM Personal Computing. In addition to the features already alluded to above, Relay features terminal emulation (VT100), several varieties of file transfer protocols (including XMODEM), keyboard customization, an unattended answer mode, a dialing directory, script commands, translation tables, a full screen editor, and extensive context-sensitive help. A big plus for IBM mainframe users is that a 3270 mode is provided—this mode, when used with PC3270 (another VMPC program) on the host machine, permits IBM 3270-series terminal operations from the PC without any special hardware. Also, files of any type may be transferred between a PC running Relay and a host computer running Relay/VM (formerly called PLEASE). The version that was tested for this review is 2.3.

## GETTING STARTED

Relay is not copy protected, but each master diskette is serialized. It may be copied easily onto a "working" diskette or a hard disk. Copies of the program that have the same serial number are not permitted to talk to each other.

The program is written in assembly language and is surprisingly small for what it does. In addition to the main program, RELAY.COM (about 44K), there is a separate help file and a set of files that contains keyboard macros, communications

scripts for a wide range of services, and miscellaneous utility programs.

Two conversion programs are provided for users whose hosts don't have the capability of doing binary file transfers. These programs do binary-to-hex and hex-to-binary conversions for use with simple ASCII file transfer functions. Because the transfer techniques provided in Relay are faster and more

***Relay requires that a name (the PC ID) be given to permit calling and answering systems to identify each other. The PC ID is input on a New User screen the first time Relay is used, and then a Modem screen asks for the type of modem.***

accurate, however, users are encouraged to take advantage of them.

Relay requires an IBM PC or a compatible machine, 128K of RAM, one 160K diskette, an 80-column display system, an asynchronous communications adapter, and any version of PC-DOS. Relay recognizes PC-DOS 2.0 and uses its more elaborate functions whenever possible. For remote access, a full-duplex modem is required. For direct connection to a host computer, no modem is necessary.

To run Relay as a 3270-series terminal on an IBM VM/370 SP operating system, the user will also need PC3270 software for the host. Relay/VM, another separate package, is needed to implement the Relay file transfer protocol on a mainframe system.

To start the program, simply type its name at the DOS prompt. The RELAY.COM file must be in the current directory on the default drive. Seven command-line options are available to customize the opera-

tion of Relay for unattended operation, automatic "load and go" operation, and various display system configurations. The menu presented upon start-up depends on the options specified and on whether the PC ID entry is filled or empty.

Relay requires that a name (the PC ID) be given to permit calling and answering systems to identify each other. The PC ID is input on a New User screen the first time Relay is used, and then a Modem screen asks for the type of modem that is attached. For all subsequent start-ups, unless told otherwise, Relay goes immediately to the OFFLINE menu (see photo 1), from which the user may select one of the primary functions.

Function key <F3> selects the function "Review the Directory of Computers," which is, in essence, a dialing directory (see photo 2). The user can point the cursor at an entry and call it by pressing <F1> or wait for a call from the named entry by pressing <F2>. Function key <F3> is used to create a new entry that is initially a copy of the currently selected entry. This copy may then be edited and named using simple commands. Finally, <F4> causes a summary of connect options to be displayed for viewing or editing.

The <Esc> key is used to back out of any screen, restoring the previous context. The only place in which this is not the case is the ONLINE menu, which requires an <F1> selection to return to the current terminal screen. Function key <F10> always gets help, as is explained in greater detail later.

## COMMUNICATIONS PROTOCOLS

Relay uses a variety of communications protocols depending on the circumstances. Garden-variety communications with information utilities, bulletin boards, and miscellaneous host machines are handled by a simple character protocol and may



# PC's \$2995 COMPAQ SWEEPSTAKES

You can win a COMPAQ IBM Compatible Portable Microcomputer System by entering PC's SWEEPSTAKES! No purchase is necessary, just mail in the completed Entry Form today! One lucky reader will win the COMPAQ PORTABLE, offering the full functions of an IBM PC with the portability of an electric typewriter!

## You're sure to win with PC!

Check the YES box as you enter and broaden your PC knowledge by subscribing to PC, The Independent Guide To IBM Personal Computers! Your subscription to PC will give you 26 big issues a year, full of new ideas, program concepts, hardware and software reviews and the latest-breaking news and events for less than \$1.10 a copy!

**USE THE ATTACHED CARD TO ENTER PC's SWEEPSTAKES AND TO BEGIN YOUR SUBSCRIPTION TO PC!**



# PC's \$2995 COMPAQ SWEEPSTAKES

## OFFICIAL ENTRY FORM

☐ **YES!** Enter my name in the PC's SWEEPSTAKES and start my subscription to PC for:

- ☐ 20 issues for \$21.97. Save 18%  
☐ 40 issues \$39.97. Save 26%

☐ NO, I don't wish to subscribe now, but tell me if I've won the PC's SWEEPSTAKES.

Mr./Mrs./Ms. \_\_\_\_\_ PC 8H401

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**Check one:** ☐ Payment enclosed ☐ Bill me later

Charge my: ☐ American Express ☐ Visa ☐ MasterCard

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Offer valid in U.S. only.

Please allow 30 to 60 days for delivery of first issue.

**NO PURCHASE REQUIRED! ENTER TODAY!**



# PC's \$2995 COMPAQ SWEEPSTAKES



Win a COMPAQ Portable  
Microcomputer system  
by entering  
PC's SWEEPSTAKES!

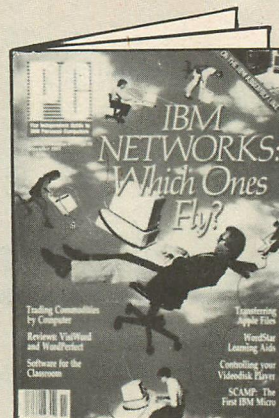
You have the opportunity to win  
a fully portable IBM compatible system  
weighing less than 28 lbs...giving you:

- Full function keyboard!
- Systems box housing the CPU Chassis, 9" phosphor screen and one 320K 5.25" double-sided disk drive!
- An MS-DOS 1.1 IBM PC Compatible system...featuring 16 bit 8088 CPU, 128K RAM expandable to 512K, Microsoft Basic included. RGB output along with NTSC. Parallel port and 3 expansion ports!
- The COMPAQ Portable will run on over 95% of the software written for the IBM PC!

**ENTER TODAY! NO PURCHASE NECESSARY!**

BE A WINNER ALL YEAR LONG...SUBSCRIBE TO *PC*, The Independent Guide to IBM Personal Computers today and pay *less than \$1.10* a copy!

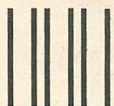
**ENTER PC's SWEEPSTAKES AND YOU MAY WIN A \$2,995 IBM COMPATIBLE PORTABLE MICROCOMPUTER!**



## OFFICIAL RULES:

### No Purchase Necessary

- On an Official Entry Form or a 3" x 5" piece of paper, hand-print your name, address and zip-code. Enter as often as you wish, but mail each entry separately to PC's SWEEPSTAKES, P.O. Box 2442, Boulder, Colorado 80322. Entries must be received no later than January 2, 1985 and the drawing will be held January 31, 1985. All entries become the property of PC Magazine, which reserves the right to reprint the name and address of the winner.
- The winner will be selected in a random drawing from among all entries received, under the supervision of the publishers of PC, whose decision will be final. Only one prize will be awarded in this Sweepstakes. Winner will be notified by mail and may be required to execute affidavit of eligibility and release. Odds of winning will depend on the number of entries received. Ziff-Davis will arrange delivery of prize. Taxes are the responsibility of the winner. Any manufacturer's claims and warranties will apply, but Ziff-Davis makes no claims or warranties with regard to any prizes. Prize is not transferable. No substitutions for prizes.
- Sweepstakes open to all residents of the U.S., its territories and possessions, except employees (and their families) of Ziff-Davis Publishing Company, its affiliates, and its advertising and promotion agencies. Void wherever prohibited or restricted by law.
- For the winner's name, send a stamped, self-addressed envelope to PC's SWEEPSTAKES, Circulation Department, One Park Avenue, New York, NY 10016.



## BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 66 BOULDER, CO

POSTAGE WILL BE PAID BY ADDRESSEE

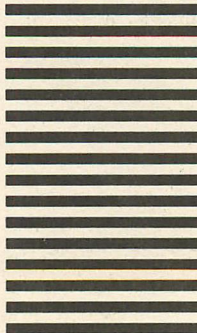


**PC's SWEEPSTAKES**

P.O. Box 2442

Boulder, Colorado 80321

NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES





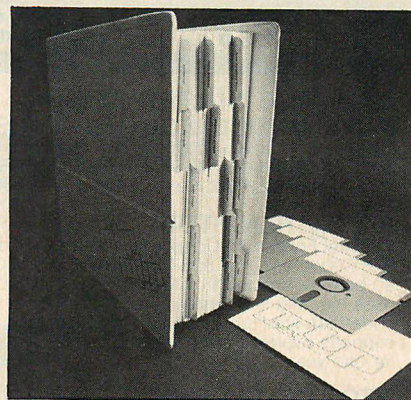
For your IBM/PC

# mbp COBOL: 4 times faster, and now with SORT & CHAIN.

mbp COBOL can be summed up  
in one word: fast.

Because it generates native  
machine language object code, the  
mbp COBOL Compiler executes  
IBM/PC\* programs *at least* 4 times  
faster (see chart). Fast also describes our **new SORT**, which can sort four-  
thousand 128-byte records in less than 30 seconds. A callable subroutine or

## \$750.



stand-alone, 9 SORT  
control fields can be  
specified. And our **new  
CHAIN** is both fast and  
secure, conveniently  
transferring control from  
one program to another, passing 255 parameters. Plus, **new  
extensions** to ACCEPT & DISPLAY verbs give better, faster  
interactive programming.

### GIBSON MIX Benchmark Results

Calculated S-Profile  
(Representative COBOL statement mix)

Execution time ratio

mbp COBOL	Level II** COBOL	R-M*** COBOL	Microsoft**** COBOL
1.00	4.08	5.98	6.18

128K system with hard disk required. \*IBM/PC is an IBM TM; \*\*Level II  
is a Micro Focus TM; \*\*\*A Ryan-McFarland TM; \*\*\*\*A Microsoft TM.

The  
complete  
COBOL.



mbp Software & Systems  
Technology, Inc.

7700 Edgewater Drive, Suite 360, Oakland, CA 94621  
Phone 415/632-1555

Please send complete mbp COBOL information to:

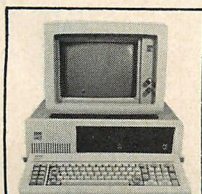
NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY/STATE/ZIP \_\_\_\_\_

PHONE \_\_\_\_\_



mbp COBOL:  
4 times faster.

An Interactive Symbolic Debug Package  
included standard; Multi-Keyed ISAM Structure;  
listing options allow source & object code, map  
& cross-reference checking; GSA Certification  
to ANSI '74 Level II; mbp has it all.

It's no surprise companies like Bechtel,  
Chase, Citicorp, Connecticut Mutual, and  
Sikorsky choose mbp COBOL; make it your  
choice, too. mbp is available at Vanpak Soft-  
ware Centers, or direct; just send the coupon,  
or call for complete information—today.

CIRCLE NO. 165 ON READER SERVICE CARD



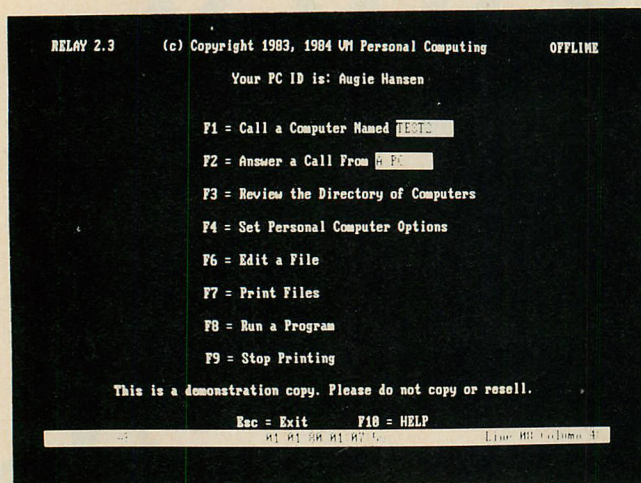


Photo 1: Relay's OFFLINE Menu

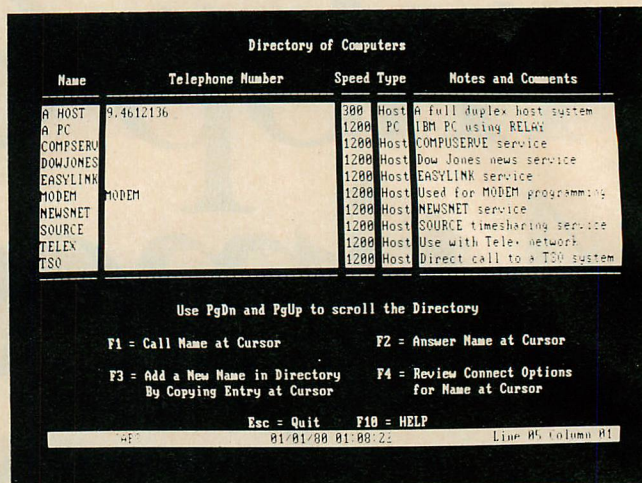


Photo 2: Selecting an Entry in Relay's Directory of Computers

include terminal emulation if the user is connected to a system that recognizes a VT100. This mode of operation is called the TTY mode.

When in the PC mode, Relay uses a proprietary packet-switching interface that has its roots in the X.25 standard. It is similar to the IBM Synchronous Data Link Con-

trol (SDLC) protocol, which is itself a subset of the High-level Data Link Control (HDLC) protocol defined in the CCITT-approved X.25 standard. The Relay protocol is designed to interleave simple messages with standard data blocks to effect full two-way simultaneous transmission on multiple virtual channels. From

the user's perspective, several separate communications may be taking place concurrently.

Figure 1 is a high-level view of a typical PC-to-PC session using Relay. System A and system B are carrying on two very different kinds of communications at the same time: a "conversation" and a file transfer.

## MicroWay™ 8087 SUPPORT and FORTRAN

**REAL TIME MULTI-TASKING/ MULTI-USER EXECUTIVE - RTOS**  
RTOS is a MicroWay configured version of iRMX-86. Includes ASM-86, LINK-86, LOC-86, LIB-86, and the ROM Hex Loader..... \$600

**87FORTRAN/RTOS™** - our adaptation of the Intel Fortran-86 Compiler generates in line 8087 code using all 8087 data types including 80-bit reals and 64-bit integers. The compiler uses the Intel large memory model, allowing code/data structures of a full megabyte, and supports overlays. Includes RTOS and support for one year..... \$1350

**RTOS DEVELOPMENT PACKAGE**  
includes 87FORTRAN, 87PASCAL, PL/M-86, Utilities, TX Screen Editor and RTOS..... \$2500

**OBJ→ASM™** - a multipass object module translator and disassembler. Produces assembly language listings which include public symbols, external symbols, and labels commented with cross references. Ideal for understanding and patching object modules and libraries for which source is not available..... \$200

\*Formerly MicroWare, Inc. - not affiliated or connected with MicroWare Systems Corporation of Des Moines, Iowa.

**MWS-286™** Configured to your specifications, our computer runs RTOS-286 or XENIX. Includes one Intel compiler, seven slot multibus chassis, hard disk, streaming tape backup and Intel Service Contract. Six to twenty times faster than your PC..... CALL

**87BASIC™** includes patches to the IBM Basic Compiler and both runtime libraries for USER TRANSPARENT and COMPLETE 8087 support. Provides super fast performance for all numeric operations including trigonometrics, transcendental, addition, subtraction, multiplication, and division..... \$140

**87MACRO™** - our complete 8087 software development package. It contains a "Pre-processor," source code for a set of 8087 macros, and a library of numeric functions including transcendental, trigonometrics, hyperbolics, encoding, decoding and conversions... \$150

**87DEBUG™** - a professional debugger with 8087 support, a sophisticated screen-oriented macro command processor, and trace features which include the ability to skip tracing through branches to calls and software and hardware interrupts. Breakpoints can be set in code or on guarded addresses in RAM..... \$150

**87BASIC/INLINE™** generates inline 8087 code! Converts the IBM Basic Compiler output into an assembly language source listing which allows the user to make additional refinements to his program. Real expression evaluations run five times faster than in 87BASIC..... \$200

**8087-3 CHIP..... \$175**  
including DIAGNOSTICS and 180-day warranty

**64K RAM Set..... \$47<sup>50</sup>**

**MATRIXPAK™** manages a MEGABYTE! Written in assembly language, our runtime package accurately manipulates large matrices at very fast speeds. Includes matrix inversion and the solution of simultaneous linear equations. Callable from MS Fortran 3.2, 87MACRO, 87BASIC, and RTOS..... each \$150

**87/88GUIDE..... \$30**

**MICROSOFT FORTRAN 3.2.... \$239**

**MICROSOFT PASCAL 3.2..... \$209**  
These IEEE compatible compilers support double precision and the 8087

**MICROSOFT C COMPILER** includes Lattice C and the MS Librarian..... \$350

**LATTICE C** with 8087 support..... \$350  
FLOAT87 for MS C..... 125

SuperSoft Fortran 66..... 329

STSC APL+PLUS/PC..... 500

TURBO PASCAL..... 45

TURBO PASCAL with 8087 Support..... 85

SIDEKICK..... 45

HALO GRAPHICS..... CALL

GRAPHMATIC..... 125

ENERGRAPHICS..... 295

Professional BASIC..... 295

COSMOS REVELATION..... 850

SCO XENIX..... 595

Unisource VENIX/86..... 800

MAYNARD WS1 HARD DISK..... 995

MAYNARD WS2 HARD DISK..... 1170

MAYNARD ELECTRONICS Boards..... CALL

**NO CHARGE FOR CREDIT CARDS  
ALL ITEMS IN STOCK  
CALL FOR COMPLETE CATALOG**

**MicroWay**

P.O. Box 79  
Kingston, Mass.  
02364 USA  
(617) 746-7341

**You Can  
Talk To Us!**



# **FORGET**

---

**EVERYTHING YOU  
THOUGHT  
YOU KNEW ABOUT  
PROGRAMMING  
IN BASIC**



# INTRODUCING BetterBASIC™

*"It combines the best points of interpreted BASIC, Pascal, Forth, & Assembler.."*

*...It's the first piece of software I'd spend my own money on."*

Susan Glinert-Cole  
Technical Editor,  
PC Tech Journal

## **Dramatically improve your productivity with BetterBASIC.™**

Introducing a new, breakthrough programming system called BetterBASIC™. At last, the structure and functionality of advanced languages such as Pascal and "C" have been combined with the friendliness and ease of use of BASIC. BetterBASIC™ will dramatically increase the productivity of both new and experienced programmers. BetterBASIC™ is also a great Teaching Language.

**Speed. Sieve of Erastosthenes Benchmark:**

- BetterBASIC: 31.9 seconds.
- IBM PC BASIC: 191.1 seconds.

**Support of large memory (to 640K).**

**Built-in WINDOWS support!**



## BetterBASIC™ offers:

- ☐ Extensibility (Make your own BASIC!!)
- ☐ Program Block Structures.
- ☐ User defined Procedures and Functions.
- ☐ Local and Global Variables.
- ☐ Shared Variables.
- ☐ Recursion.
- ☐ Argument type validation.
- ☐ Optional arguments.
- ☐ Arguments passed by-value or by-address.
- ☐ Separately compiled program Modules.
- ☐ Simple interface to Assembly Language Procedures.
- ☐ Support for OEM hardware through extensibility.
- ☐ Useful set of Data Types:
  - Byte, Integer.
  - Real (Variable precision BCD)  
Ideal for business math.
  - String (up to 32768 characters).
  - Record Variables & Structures.
  - N-dimensional Arrays of any type.
  - Arrays of Arrays.
  - Pointer (of any type).

## General Information:

- ☐ Interactive programming language based on an incremental compiler.
- ☐ Syntax checked immediately on entry, with concise error reporting.
- ☐ Built-in Screen Editor allows on-line editing.
- ☐ Built-in Linker for separately compiled program Modules.
- ☐ Built-in Cross Reference Lister
- ☐ Comprehensive 580 page manual.
- ☐ 8087 MATH support.
- ☐ IBM PC, IBM PC/XT or compatible.
- ☐ PC/DOS 1.1, 2.0, 2.1.
- ☐ 192K to 640K memory.
- ☐ Usable on plain MS-DOS machines with reduced functionality.  
(No Editor, Graphics or Windows)

*Better*  
**BASIC**

We are so sure you will like BetterBASIC, we will give you a 30-day money-back guarantee. Order BetterBASIC now!  
**PRICE \$199.00**  
**8087 MODULE \$99.00**

Not convinced? Then try the BetterBASIC Sample and you will find that BetterBASIC is truly a major breakthrough in computer programming.  
**SAMPLE DISK: \$10.00**

**You can find BetterBASIC by calling us at 617 235-0729**

Master Charge, Visa, P.O., Checks, Money Orders, and C.O.D. accepted.



**Summit Software Technology™ Inc.**

P.O. BOX 99, BABSON PARK, WELLESLEY, MA 02157

BetterBASIC is a trademark of Summit Software Technology, Inc.  
IBM PC, IBM PC/XT and PC/DOS are trademarks of International Business Machines Corp.  
MS-DOS is a trademark of Microsoft Corp.

CIRCLE NO. 177 ON READER SERVICE CARD

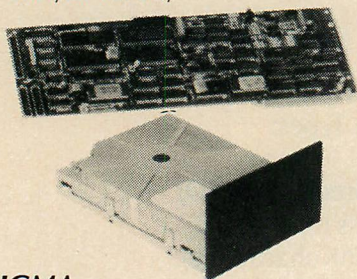


FOR YOUR IBM PC

**Creative Edge** **\$799**

## 10 MB HARD DISK

- includes 10 MB drive, controller, cables & installation instructions
- one year warranty



### SIGMA

**10 MB HARD DISK . . . \$895**

**EXPANSION CHASIS . . . \$695**

- includes chasis, power supply, 9-slot backplane, 2 interface boards & cable

**MEGA FLOPPY . . . . . \$749**

- 2.6 MB capacity per disk (8 times capacity of standard DS drives)
- includes floppy controller card, disk drive, 2 diskettes, cables & software
- 500 KHZ data transfer rate

### STREAMING TAPE BACKUP

- 45 Megabyte capacity
- fast 5 MB per minute data transfer rate
- software allows backup of entire disk or individual files/directories
- includes controller, drive, cables, interface to PC & software.

**. . . \$1195**

### DYSAN 5¼ INCH FLOPPY DISKS 104/2D - DS/DD

- 10 disks w/library case . . . . . \$37
- 20 or more disks . . . . . \$35

### IBM COMPATIBLE

Multifunction Board w/64K . . . . .	\$249
Monochrome Card . . . . .	\$225
Color Adapter . . . . .	\$235
Floppy Controller . . . . .	\$169
TAXAN, AMDEK, PGS Monitors . .	\$CALL
OKIDATA, CITOH Printers . . . . .	\$CALL
HAYES 1200 Smartmodem . . . . .	\$469
HAYES 1200B . . . . .	\$419

Write or Call For Our Free Product List

**Creative  
Microsales**

171 Mayhew Way, Suite 211  
Pleasant Hill, CA 94523

**(415) 945-1201**



OUTSIDE CALIFORNIA  
CALL TOLL FREE



**800-321-3342**

CIRCLE NO. 125 ON READER SERVICE CARD

## RELAY

Each user may type on his or her keyboard to send "messages" to the distant system. Typed characters are echoed locally to the bottom half of the terminal screen. Each line of characters is formed into a message and sent to the other system to be displayed in the top half of the receiving system's terminal screen. Each user can view a window of text for each end of the link. When the windows fill up with text they are scrolled independently so that they show the latest transmitted and received messages.

While the conversation is continued, blocks of data are being transferred from system A's disk to a disk on system B. Each block of data has a virtual channel identification and a sequence number that allows the receiving system to put the data blocks back together correctly if they arrive out of order for any reason. Each virtual channel is actually bidirectional, so data can flow in either direction.

Relay places a higher priority on messages than on data packets, so the individual messages of a conversation can be shoved in between data packets. It is unlikely that anyone will type in messages fast enough to slow down the overall file transfer rate appreciably.

When a Relay-equipped PC is connected to a host that is running RELAY/VM or PC3270, proprietary protocols are used to handle the special requirements of each mode.

### FILE TRANSFERS

Relay accommodates all file transfer methods currently in vogue, from those that send one character at a time to those that send multiple blocks of data synchronously.

Files that contain only ASCII text may be sent in Relay's TTY mode using XON/XOFF flow control or sending one line at a time with a pause-proceed handshaking method that uses an assignable character (usually carriage return) as the turnaround character.

Binary files require more elaborate transfer techniques; several are provided. XMODEM is available in two flavors: the first matches the original CP/M description and uses a checksum error-detection scheme, and the second is a derivative of XMODEM now available on some bulletin boards. The second method uses the cyclical redundancy check (CRC) error-detection technique, which is able to detect compound bit errors that could fool a simple checksum method. The selected XMODEM option must be compatible with the version on the other end of the link for file transfers to be completed successfully.

The Relay protocol discussed earlier is provided for PC-to-PC communications in which both ends are equipped with Relay and for PC-to-mainframe communications in which Relay is present on the PC and Relay/VM is on the mainframe.

Good user feedback is provided on the message line at the bottom of the terminal screen and on a status screen that can be called up at any time to see how the communications session is progressing.

### THE MAINFRAME CONNECTION

VMPC has obviously targeted the IBM mainframe market with Relay, and the product's 3270 mode hits the bull's eye for that market. Unlike most other 3270-series emulation products for the IBM PC, Relay requires no special hardware and only a companion software product for the mainframe side of the link. PC3270, sold separately, is a program that runs on the VM/370 SP operating system. It provides the interface that Relay needs in order to be able to simulate on the PC all of the functions of an IBM 3270-series terminal interface.

To set up for 3270 operation, it is necessary to select some connect options that set up Relay in the PC mode and to associate the options with a VM/CMS system name and



# RELAY

number in the directory of computers (this needs to be done only once for each VM/CMS system to be contacted). Once the software is installed and running, the PC will be able to display program menus and full screens of text for editing using mainframe programs in the same way a 3270-family controller and terminal would.

Relay/VM, which simulates a Relay-equipped PC-like interface on the host, is used to perform file transfers between a PC and a VM/CMS mainframe. When this software combination is running, any type of file may be uploaded or downloaded with Relay's error-checking and correction applied.

## VT100 TERMINAL EMULATION

VT100 terminal emulation is the weakest element of Relay. This mode is a recent addition, and it is not as complete as those of some competing programs (see "High-tech Mimicry," *PC Tech Journal*, September 1984, page 46, for a comparison of emulation programs).

Because the VT100 set-up screen is not implemented, it is not possible to toggle the margin bell on/off—it is permanently off. PC hardware limitations preclude such features as 132-column mode, double-height and double-width characters, smooth scrolling, and foreign-language character sets. VMPC has elected to leave out the LED display function and line wraparound control (always on). The desirable editing features (insertion and deletion of lines and characters) of the VT102/132 terminals that are supported by some VT100 emulators are not currently available in Relay.

Several popular mainframe visual text editors use the <Esc> key to perform special functions, such as exiting the input mode or forming special commands. Because <Esc> is used by Relay to mean "Go back to the previous context," and because it cannot be reassigned,



**IBM PC & XT**

64K PC, keyboard, no drive, no controller card . . . \$1,250  
 64K PC, keyboard, 1 IBM drive \$1,649  
 64K PC, keyboard, 2 IBM drives \$1,895  
 64K PC, keyboard, 2 half height drives, a 10-MB hard disk . . . \$2,995  
 128K XT, keyboard, 1 floppy drive & a 10-MB hard disk . . . \$3,595  
 For each 64K Memory . . . add \$50  
 256K Portable, 1 IBM drive . . . \$2,295  
 256K portable, 2 IBM drives . . . \$2,695  
 IBM Color/Graphic Card . . . \$2,335  
 IBM Monochrome printer Card . . . \$235  
 IBM Monochrome Monitor . . . \$255

**IBM WORD PROCESSING PACKAGE**

- 256K IBM-PC with keyboard
- Two double-sided drives
- IBM monochrome display
- IBM display/printer adapter
- IBM DOS 2.10
- Abati LO-20 letter quality daisy-wheel printer, 18 CPS
- Parallel printer cable

List \$3,648.00 All for only—\$2,789  
 You save over 23%!

### SOFTWARE FOR IBM PC

**Lotus 1-2-3** . . . \$289  
**Symphony Upgrade Kit** . . . \$149  
**SYMPHONY** . . . \$449  
**dBASE II** . . . \$285  
**dBASE III** . . . \$399  
**dBASE II Upgrade Kit** . . . \$149  
**FRAMEWORK** . . . \$449  
**WORDSTAR PRO PAK** \$355  
 Microsoft Word with Mouse . . . \$275  
 Multiplan . . . \$119  
 SuperCalc II . . . Close-out! \$125  
 Dollars & Sense . . . \$139  
 R-Base 4000 . . . \$289  
 Hayes Smartcom II . . . \$79  
 Crosstalk . . . \$115



**Compaq** 128K, 1 drive . . . \$1,995  
 Compaq 256K, 2 drives . . . \$2,295  
 CompaqPlus 128K, hard disk . . . \$3,595  
 CompaqPlus 256K, hard disk . . . \$3,695



**ROLAND DXY-800 Plotter**

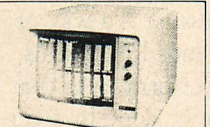
Now includes free software

8-pen intelligent X-Y Plotter. Hi-speed 180mm/sec. IBM-PC compatible. 11" x 17" paper size. Horizontal or vertical operation. Dual speed switch. Parallel and serial interfaces. . . . \$795

### MONITOR SALE

FREE interface cable included!

\*\*\* RGB COLOR \*\*\*



**PGS HX-12**, 12" RGB color, high res. 690x200-dot, 16-color . . . \$469  
**PGS SR-12**, 12" GRB color, super high res. 690x400, w/interface card \$925

**Quadrachrome 12"** RGB color, super hi. res. 690x480-dot, 16-color . . . \$495  
**NEC J012160FA**, 12" RGB, 640x300 dot, w/interface cable . . . \$449

\*\*\* GREEN SCREEN \*\*\*

**IBM Monochrome 12"**, 720-dot \$255  
**Dynax GM-120**, 12" green, high resolution 600-dot, 20 MHz . . . \$129  
**XENON 12"** green, high resolution, 800-dot, 20 MHz, comes with tilt & swivel base, grey cabinet matched the IBM-PC. A special buy! \$119

**Roland MB-122G**, 12" green, 18 MHz, hi-resolution 720x350 dots, fully compatible with IBM monochrome display card . . . \$179

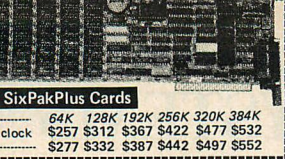
\*\*\* AMBER SCREEN \*\*\*

**Dynax AM-121**, 12" amber, 600-dot, hi resolution, 20MHz . . . \$139  
**Xenon 12"** amber, hi. res. 800-dot, w/tilt & swivel base . . . \$125  
**Princeton MAX-12**, 12" amber, 720 x 350 dot, runs off IBM monochrome display adapter . . . \$199  
**Amdek 310A**, 12" amber, 900-dot, hi resolution, designed to run on IBM monochrome display card . . . \$165

All merchandise is brand new & fully guaranteed. All prices reflect 3% cash discount for full payment by cash, cashier's check or money order. Personal or company check requires 2-3 weeks to clear. Visa, MasterCard, American Express cards & PO's accepted from qualified customers. COD's accented with 20% paid deposit plus \$3 COD fee (by UPS only). No COD's to Canada or FPO/APO. Shipping/insurance/handling charges: 3% of total order value by UPS Surface, 5% by UPS Air & Parcel Post (Min. \$3). Calif. residents add sales tax. No sales tax on out-of-state orders. Prices & availability subject to change without notice. 9/18/84

## EASTERN ENTERPRISES, INC.

Mass Merchandising Since 1969  
 2937 S. VAIL AVE., LOS ANGELES, CALIF. 90040  
 (Hours: Monday-Friday 8:30am-4:30pm Pacific Time)



**AST Multi-Function Cards for IBM PC and XT**

Memory installed on card . . . 64K 128K 192K 256K 320K 384K  
 with parallel, serial ports & clock . . . \$257 \$312 \$367 \$422 \$477 \$532  
 above plus game port . . . \$277 \$332 \$387 \$442 \$497 \$552

### SixPakPlus Cards

9-Function Memory Expansion Card  
 • Up to 384K • Chronograph • QuadRAM drive  
 • Game port • Parallel port • Master spool  
 • Qswap • Serial port • I/O bracket

Amount of memory installed . . . OK 64K 128K 192K 256K 320K 384K  
 w/parallel, serial, game ports, clock \$235 \$275 \$325 \$375 \$425 \$475 \$535  
 Add Multi-Tasking to your IBM-PC and XT now!

### TASC MASTER software with

**AddRam Elite** or **AddRam Plus** Ultimate Multi-Function Boards

**AddRam Elite** (parallel & serial ports) **AddRam Plus** (Two serial ports)  
 Memory installed . . . 64K 128K 192K 256K 320K 384K 448K 512K  
 \$399 \$459 \$519 \$579 \$639 \$699 \$759 \$819

### HERCULES GRAPHICS CARDS

Creates hi-resolution graphics on the IBM monochrome . . . \$349  
 Paradise Multi-Function Card . . . \$399  
 monochrome displays, w/parallel port . . . \$399  
 Vista Disk Master - Disk controller card for both 5 1/4" & 8" drives, IBM-PC/XT compatible . . . \$169  
 Printer Interface Card - A half size card for short slot . . . \$69  
 Ideal for use with color display . . . \$69

### Special Purpose Cards

**Plantronic COLORPLUS** - offers more colors in hi. res. mode, w/printer port . . . \$379  
**Techar Graphic Master** - highest res. in color & mono displays w/graphics . . . \$499  
**STB GraphicsPlus** - operates color & mono displays w/graphics & printer port . . . \$499  
**Multigraph Card by Profit Systems** - 640x400 dots - 16 colors in color mode, 720x350 dots in monochrome, plus hi. res. graphics w/132-column display . . . \$499  
**Koala Graphics Pad w/software** for IBM-PC. Requires color card & game port . . . \$125  
**Quadcoder I** - offers twice amount of memory & 2 true colors in hi-res. mode . . . \$219  
**Quadcoder II** - A daughter board for Quadcoder I, adding 2 more screen modes, 136 colors in med. res. mode and 16 colors in hi. res. mode, plus game port \$229  
**Persyst Color Display Card** - gives same quality features as IBM color card . . . \$195  
**MonographPlus Card by AST** - offers hi. res. graphics on monochrome display, Lotus 1-2-3 and Hercules compatible. With parallel port & clock/calendar . . . \$445  
 Optional serial port for MonographPlus . . . \$35

### 5 1/4" DISK DRIVES

**Tandon TM-100-2**, full ht. DSDD . . . \$179  
**Tandon TM-100-4**, full ht. DSDD . . . \$289  
**Control Data 9409**, full ht. DSDD . . . \$215  
**Control Data 9428**, half ht. DSDD . . . \$189  
**Teac 55B**, half ht. DSDD . . . Sale! \$149  
**EMEX 2.3** height DSDD . . . Sale! \$99  
**IBM full height**, DSDD . . . \$219  
**IBM half height**, DSDD . . . \$325  
**Mitsubishi (same as Panasonic)** 1/2 ht. . . \$145  
**Qume 142**, half ht. DSDD . . . \$229  
**Shugart SA455**, half ht. DSDD . . . \$189  
**Toshiba 4851**, half ht. DSDD . . . \$195

### Hard Disk Sale

**Maynard WS-1**, 10MB hardisk w/Sandstar multifunction card & hard disk controller module . . . \$995  
**Maynard WS-2**, 10 MB hardisk w/Sandstar floppy disk & hard disk controller module . . . \$1150  
**Maynard WS-3**, 10 MB hardisk w/Sandstar memory card/mem. J. \$1,149

**CMS Hard Disk Plus** - 10 MB hard disk w/controller card. Boots without diskette. . . . a fantastic buy!

### Sysgen

**TAPE BACKUP**

An economical way to back up 10MB in 4 minutes on a single cassette . . . \$875

### DYNAMIC RAM CHIPS

4164 (64K) 200 nanosec. \$5.95 ea. 9/5/85  
 4164 (64K) 150 nanosec. \$6.95 ea. 9/5/85

### 8087 CHIP

Latest Intel 8087-3 high speed math coprocessor . . . \$169

### Modem Sale!

**Hayes 300**, external, 300 baud . . . \$199  
**Hayes 1200**, external, 1200 baud \$485  
**Hayes 1200B**, internal w/software \$429  
**Hayes 1200B**, above w/o software \$385  
**Bizcomp Intellimodem 1200** . . . \$429  
**Prometheus ProCom 1200** w/clock \$429  
**Navigation Access 123** . . . \$399  
**Ventel Nova**, 1200 baud, fits slot in IBM-XT & portable . . . \$425

### THE POWER DIRECTORS

**P2** - A unique control center and surge protector w/5 lighted and a master reset switch for your computer & accessories. It also filters out EMI & RFI interferences . . . \$125  
**P12** - Similar to P2 but w/6 switches, a master switch & digital clock. . . \$179

### DATASHIELD

Model 100, 6-plus surge & noise protector w/audio & visual warning . . . \$65  
 PC-200, 200-watt power supply backup which will take over within 10 milliseconds. Built-in surge protector \$295  
 XT-300, above but 300-watt . . . \$395



**EPSON**

**MX-100 F/T**, 80 column, Close-out \$329  
**MX-100 F/T**, 132 col. Close-out \$499  
**RX-80**, 120 cps, 80 col. tractor fd Call  
**FX-80 F/T**, above plus friction fd Call  
**FX-80**, 160 cps, 80 col. . . . Call  
**FX100**, 160 cps, 132 col. . . . Call  
**LO-1500**, 136 col., 24-pin head, 200 cps draft, 67 cps letter quality. Friction feed, available now . . . Call

### STAR GEMINI

**Gemini-10X**, 120 cps, 80 col. . . . Call  
**Gemini-15X**, above w/132 col. . . . Call  
**Delta-10**, above but 180 cps . . . \$599  
**Delta-15**, above w/132 column . . . Call  
**Radox-10**, 200 cps, 80 column . . . Call  
**Radox-15**, 200 cps, 132 column . . . Call

### Call

**8510AP**, 120 cps, 80 column . . . \$319  
**8510-SP**, above but 180 cps . . . \$499  
**8510-SCP**, above but w/3 color ribbon to generate 7 colors . . . \$599  
**1550**, 120 cps, 132 column, Par. . . \$525  
**1550-SP**, above but 180 cps . . . \$699  
**1550-SCP**, above but w/colors . . . \$799  
**F-10**, 40 cps daisywheel, parallel \$915  
**F-10**, 55 cps daisywheel, parallel \$919  
 Tractor for F-10 . . . \$225

### OKIDATA

**82A**, 120 cps, 80 col. Ser. & Par. . . \$315  
**83A**, 120 cps, 136 col. Ser./Par. . . \$595  
**84P**, 200 cps, 136 col. Parallel . . . \$759  
**92P**, 160 cps, 80 col. Parallel . . . \$399  
**93P**, 160 cps, 136 col. Parallel . . . \$635  
**2410P**, 350 CPS, 136 col., friction & tractor, 2-color, (parallel) . . . \$2,195

### RITEMAN

120 cps, 80 col. 9x9 matrix . . . \$269

### IBM PC COLOR PRINTER

A high speed dot-matrix printer for graphics & text at speed up to 200 cps and up to 8 colors . . . Sale! \$1,595

### IDS PRISM

**IDS Prism 80**, 200 cps, 80 col., graphics, tractor/friction feed, parallel \$1,159  
**IDS Prism 80B**, above + 4-color \$1,299  
**IDS Prism 132**, similar to Prism 80 but 132 columns available . . . \$1,385  
**IDS Prism 132C**, above + 4-color \$1,495

### PANASONIC

**KX-P1091**, 120 cps, 80 columns, with near letter quality mode . . . \$335

### TOSHIBA

24-pin print head for highest resolution! 192 cps draft, 100 cps letter quality! **P1351** - 132 column, parallel. \$1259  
**P1340** - above but 80 column . . . \$725  
**Cutsheet Feeder** . . . \$1,385  
**Bi-Directional Tractor** . . . \$799

### HEWLETT PACKARD

**H-P Thinklet Ink Jet Printer**

150 cps . 80 column, 11x12-dot text, 96 or 192x96-dot graphics, drop-in ink cartridge, whisper quiet, compact 11x8x3 1/2", 6 lb. . . . \$445

### H-P LASER PRINTER

Available Now! It prints almost as fast as a copying machine . . . \$CALL

### BROTHER

**HR-1A**, 18 cps heavy-duty daisywheel printer . . . Close-out Sale \$449  
**HR-15**, 13 cps daisywheel printer with 2-color printing . . . \$369  
**HR-25**, 23 cps daisywheel printer with 2-color printing, 3K buffer. . . \$619  
**HR-35**, 36 cps daisywheel printer \$999  
**HR-45**, 36 cps daisywheel printer \$119  
**Cut sheet Feeder** . . . \$199

### DYNAX DX-15

Letter quality daisywheel printer with 2-color printing, 13 CPS. . . \$CALL  
 Cut sheet feeder . . . \$199  
 Tractor . . . \$119  
 Keyboard . . . \$179

### JUKI 6100

18 CPS daisywheel, 13" platen, 2K buffer, 3-pitch, (parallel) . . . \$415

### FUJITSU

**SP-830** - Super fast 80 cps daisywheel printer . . . \$CALL  
**SP-320** - above but 48 cps . . . \$CALL

TOLL-FREE (800)392-7081 (ORDERS ONLY)

Calif., Alaska, Hawaii & all info. Call

(213)725-3080





# TALL TREE SYSTEMS

INTRODUCING

## JRAM-2

THE ONLY  
TWO MEGABYTE  
MULTI-FUNCTION  
BOARD

Break through the 640K-byte memory barrier! Put two MEGABYTES of RAM *plus* all the most popular I/O functions—serial ports, parallel ports, and clock/calendar—in a single PC slot! Includes JETDRIVE RAM disk and JSPOOL printspooler.

### JRAM-2 OPTIONS

JRAM-2 0K .....	\$219
JRAM-2 0K, Clock/Cal .....	\$299
JRAM-2 0K, Serial, Parallel ports, Clock/Cal .....	\$399
JRAM-2 0K, Two Serial ports ..	\$349
JRAM-2 0K, Two Serial ports, Clock/Cal .....	\$399
JRAM-C (For Columbia PC) 0K, Clock/Cal .....	\$249

### MEMORY

64K chips \$50/Bank  
256K chips \$500/Bank

### DOS 2.0, 2.1 SOFTWARE

JETDRIVE .....	\$60
WINDRIVE .....	\$60
JFORMAT-2 .....	\$60
JSPOOL .....	\$60

## TALL TREE SYSTEMS

1032 ELWELL COURT, SUITE 124  
PALO ALTO, CA 94303  
(415) 964-1980

## RELAY

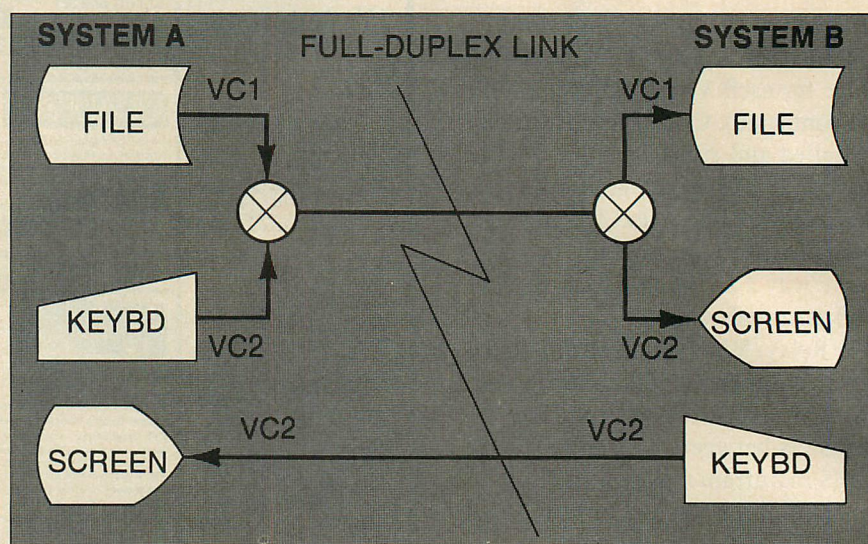


Figure 1: A High-level View of a PC-to-PC Session Using Relay

the <F2> key is used in the terminal mode to send the escape (decimal 27) code to the host.

I had trouble adapting to this juxtapositioning of keys and frequently found myself staring at a main on-line menu instead of the text I was editing. It is easy to recover from this (just type <F1>), but it's a nuisance nonetheless. Giving the user the ability to reassign the function to another key (as Crosstalk XVI's SWITCH function does, for example) would be a significant improvement.

### AUTOMATIC PROCESSING AND SCRIPTS

Automatic processing is a way of having an unattended PC that is running Relay perform tasks that would otherwise be done by a human operator. The tasks are the repetitive kind that usually have a pattern of known or expected exchanges, although conditional branching and comparison operators are available to handle considerable variation in conditions and data. Relay provides three levels of automatic processing that may be used individually or together.

1. DOS level—with DOS 2.0 (or later versions), batch files may be used to start Relay and, based on the return code when Relay

exits, to run any DOS commands and other applications software. Relay can also use the redirection capabilities of DOS 2.0 (and later versions) to produce activity logs. In addition, a WAIT.COM command that can be used with any version of DOS is provided; when this command is used, Relay will wait for specified dates and times before running commands.

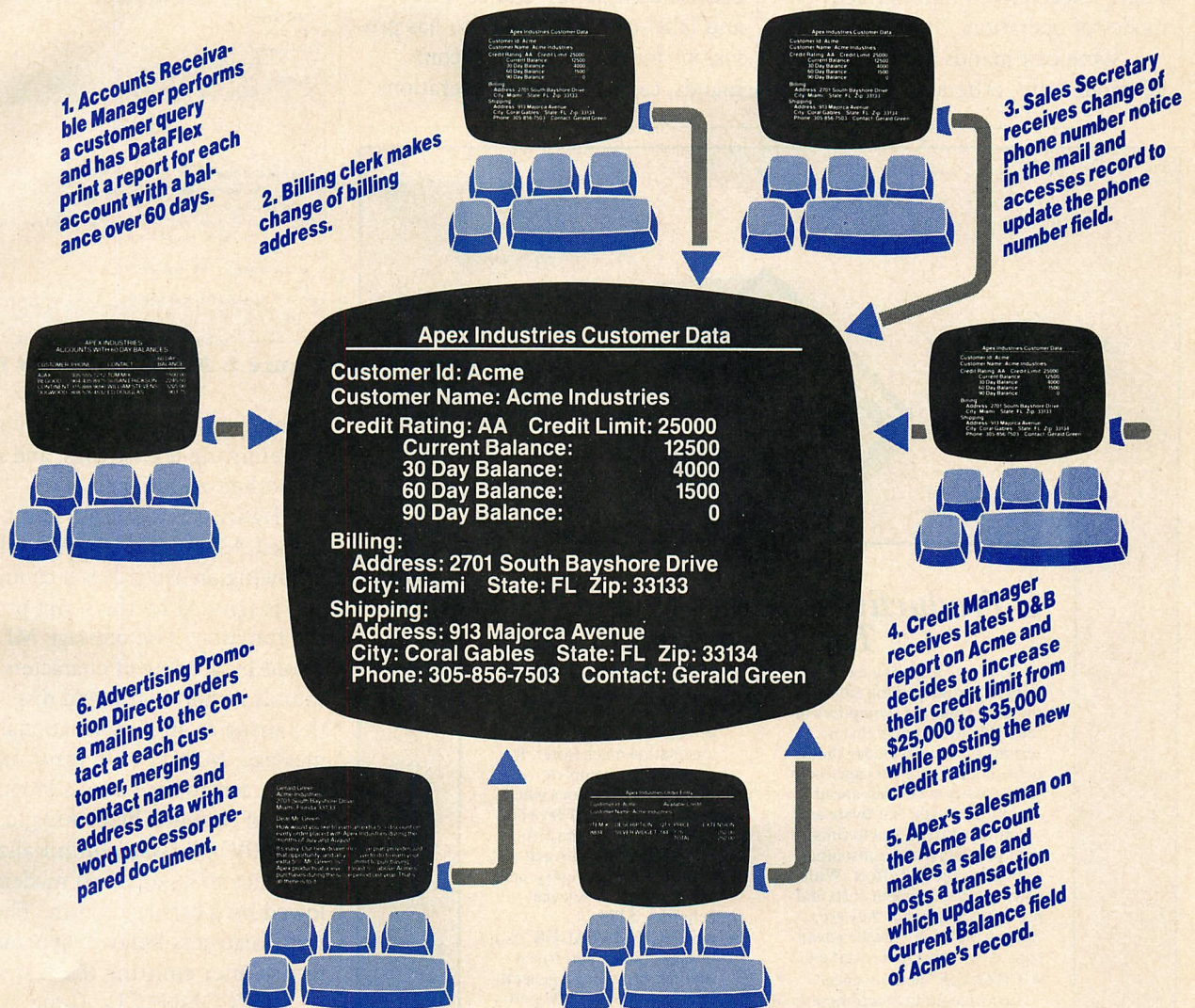
2. Relay level—Relay accepts command-line options to control its behavior in limited ways (how long to wait for a call, setting up an activity log). It also provides return codes that can be used by DOS batch file commands as described above.
3. Relay script level—files written in Relay Script Language that have an .SCR file-name extension may be used to perform a wide variety of tasks, such as automatic log-on and log-off sequences, automated file transfers, and other functions. Functions packaged in script files may be used as modules called from other scripts to automate Relay communications sessions fully.

Because Relay is a menu-controlled program, it does not have an English-language command syntax of the kind used by Crosstalk XVI. The Relay Script Language tends to



# ALL AT ONCE!

## AND NEVER A "LOCKED OUT" USER!



DataFlex is the only application development database which **automatically** gives you true multi-user capabilities. Other systems can lock you out of records or entire files for the full time they are being used by someone else. DataFlex, however, locks only the data being changed, and **only** during the micro-seconds it

takes to actually write it to the file! The updated record is then immediately available. The number of users who can access, and change, records at the same time is limited only by the number of terminals on your system or network. Call or write today for all the details on DataFlex... the true multi-user database.

# DATA FLEX™

8525 SW 129 Terrace, Miami, FL 33156 (305) 238-0012  
 Telex 469021 DATA ACCESS CI  
 CIRCLE NO. 146 ON READER SERVICE CARD

Compatible with CP/M-80, MSDOS networks, MP/M-86, Novell Sharenet, PC-Net, DMS Hi-net, TurboDOS multi-user, Molecular N-Star, Televideo MmmOST, Action DPC/OS, IBM PC w/Corvus, OMNINET, 3Com EtherSeries and Micromation M/NET.  
 MSDOS is a trademark of Microsoft. CP/M and MP/M are trademarks of Digital Research.

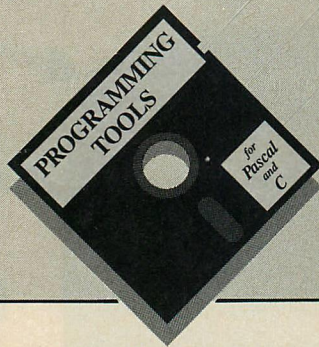


# RELAY

be terse and not particularly mnemonic, which made it a chore to write a script. Using this language takes practice and ready access to the user's guide. Once learned, however, it brings considerable power to Relay, especially in unattended modes of operation.

Some commands are usable in PC mode only, others are usable in

TTY mode only, and many are available in both modes. The language provides conditional and absolute branching, comparison operators within conditional tests, a variety of screen, keyboard, and port control commands, and comment and label commands. It also has provisions for executing DOS commands, canceling active operations,



## C Productivity Series— The Professional's Edge

Blaise Computing has a range of programming aids for the most popular C compilers in the IBM environment that no serious system developer should be without. These packages help you to easily access advanced capabilities of the hardware and operating system, and to finish your projects with a substantial saving of time and effort. With software development costs and pressures as great as they are, can you afford not to take advantage of the finest tools available?

- ◆ **C TOOLS™** puts advanced string handling functions at your disposal and provides a high-level interface to all BIOS functions from your C program. Complete screen handling, graphics primitives, and a substantial group of useful, general-purpose functions are also featured. **\$125**
- ◆ **C TOOLS 2™** lets your program perform all the advanced DOS 2.0 services. Program chaining, software interrupt handling, and dynamic memory allocation are all done "right." Buffer and file handling functions are provided, as well as a general DOS gate. **\$100**

- ◆ **C VIEW MANAGER™** is our display screen management system that makes screen development and documentation much faster. It comes with a complete library of C functions which use the screens you have developed to recall and display information, capture and validate field data entry, and provide context-relevant help files. **\$275**

- ◆ **ASYNCH MANAGER™** is a library of interrupt-driven routines providing a general interface to both COM ports for your asynchronous communications applications. Introductory price of **\$175** includes all source.

All of these products may be used by developers with no royalty payments to Blaise Computing. Source code either comes with the package, or is available. We support Lattice, Computer Innovations, and Microsoft C compilers. To expedite your order or to obtain further information, call or write us directly.

*Blaise Computing's Programmer Productivity series is also available in versions for the Pascal language.*

### BLAISE COMPUTING INC.

2034 Blake Street Berkeley, CA 94704  
(415) 540-5441

```
*
* RELAY 2.3 - Sample ANSWER script for Hayes Smartmodem
*
* (c) Copyright 1983, 84 by VM Personal Computing, Inc.
*
* This script demonstrates RELAY's support for general
* "intelligent" modems by calling via a Hayes Smartmodem.
* Of course, RELAY's native Smartmodem support is more
* advanced; you should use this script only as a sample.
*
MIWaiting to answer the telephone ... Please stand by.
* First, prepare the modem ...
CATEOV1Q0
W3COK
IFW Error
* Wait for RING reply ...
WCRING
* Answer the phone ...
CATA
* Wait for the result line ...
W1OC
W3C
IFS/CONNECT/ Gend
* No carrier or similar error ...
MENo Carrier on line!
FX2
* The modem is not responding ...
-error
MEYour modem is not responding!
FX1
* Connection complete ...
-end
```

**Figure 2: A Sample Script File**

running other scripts, displaying and emitting text strings, and myriad other operations.

Figure 2 is a sample script file named ANSWER.SCR. Anything following an asterisk is a comment and is ignored by the script-processing function. The message MI followed by a string of characters sounds a short alarm and displays the string as an "informational" message. MEmtext is an error message that is accompanied by a longer burst of sound. The command CATEOV1Q0 issues an initialization sequence to an attached modem, followed by a carriage return. The letter C instructs Relay to append the return after emitting the text string.

IFS/CONNECT/ Gend is a conditional expression that checks to see if the result of the previous wait command (W3C) was the string CONNECT. If the correct string was received, the Gend command, which means GOTO the label "-end," is executed. Otherwise, an error message is displayed and a warning tone sounded. Considerable flexibility and power is available through the use of scripts.

## UNATTENDED ANSWER MODE

Relay may be set up to run unattended and to answer calling sys-



# Now, X-shell™ brings Unix™ capability to your PC for an amazingly low \$295

Computers. You know at least two things about them: One, they should be a tool for solving your problems. Not creating them. Two, you want to spend as little time as possible on one.

## X-shell Software Tools Package

That's why Standard DataCom, Inc. developed X-shell, a command interpreter software tools package for IBM PCs and MS-DOS/PC-DOS operating systems.

X-shell helps your computer solve your problems faster. Makes the time you spend on the computer more efficient. Squeezes more out of your computer investment.

## Proven Unix Features

X-shell gives you Unix capability by providing these proven Unix features:

1. Support for pipelines and filters
2. Input & output redirection
3. Variable substitutions
4. Command substitutions
5. Filename expansion
6. Nested command files
7. Structured flow control:  
if/then/else, while/do/done,  
until/do/done, case/esac,  
for/do/done

## Hardware Requirements (where you can save hard cash)

IBM PC or XT (or compatible)  
256K bytes of RAM

2 Disk Drives—Hard or Floppy

Since X-shell can be run using floppy disk drives, you can save a bundle of money on your hardware. Hard disks are expensive. Floppies aren't. It's that simple.

## Software Requirements

PC-DOS version 1.1 or 2.0  
Software Disk Emulator

Since X-shell runs on PC-DOS, it supports existing PC-DOS software.

## Over 40 Commands

X-shell's commands  
include:

basename	-strip extension from file name	num	-number lines
cat	-concatenate files	pr	-format files for printing
cd	-change directory	print	-pr directed to printer
clear	-clear monitor screen	pwd	-print working directory
cmp	-compare files	rm	-remove files (delete)
comm	-output lines common to two files	sh	-shell (command interpreter)
cp	-copy files	size	-size of object code
cpio	-file backup/archival	sort	-sort numerically or alphabetically
date	-get or set date and time	sum	-checksum file
echo	-echo arguments to stdout	tail	-output last lines of file
expand	-expand tabs into spaces	tee	-pipe fitting
expr	-string and arithmetic evaluation	test	-test file's or string's characteristics
false	-do nothing, unsuccessfully	time	-determine time to execute a command
find	-produce list of selected files	tr	-translate or delete characters
grep	-search files for specified pattern	true	-do nothing, successfully
hd	-hex file dumper	unexpand	-replace spaces with tabs
head	-output 1st lines of file	uniq	-remove duplicate lines
ls	-sorted directory list	wc	-count chars, words and lines
more	-copy files to display	words	-output file 1 word per line
mv	-move files (rename)		

## What You Get For \$295.

1. Complete Documentation, including: Installation, Tutorial and Reference Manuals.
2. Complete X-shell Software Tools Package on two diskettes.
3. A more efficient use of your computer time.
4. More effective use of your PC.

## How To Order X-shell

Get the software package that gives you Unix capability for an amazingly low \$295.

Call Standard DataCom, Inc. 415-775-8882 with your Visa or MasterCard order, or for more information.

Or ask your dealer.

**Standard  
DataCom,  
Inc.**   
*X-shell*™

Ask us about X.25

Standard DataCom, Inc.,  
1550 California Street #6195,  
San Francisco, CA 94109

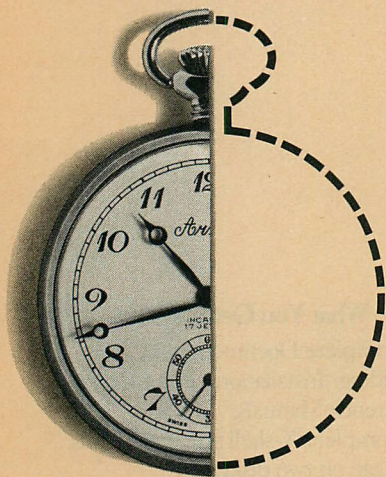
Unix is a trademark of Bell Laboratories  
X-shell is a trademark of Standard DataCom, Inc.

**Dealer Inquiries Invited**

CIRCLE NO. 299 ON READER SERVICE CARD



# Mylstar can cut your IBM-PC debugging time in half.



## *Introducing MSD! Mylstar Symbolic Debugging Program for IBM Personal Computers, PC-DOS V 1.1, 2.0 and 2.1.*

MSD greatly enhances your IBM DEBUG Program. Using the same command structure as DEBUG, it lets you substitute symbol names and mathematical expressions for hex values. On-line help, multi-command macros and other time saving entries are also included. Even use symbols with assembly command.

### *MSD adds on what IBM left out.*

Every symbol declared public in a source module becomes part of the symbol table. MSD contains commands for break points, repeat loops and input/output redirection. It lets you define macros which can be saved and used again. MSD also offers a Command to trace around calls, DOS interrupt calls, and repeat string instructions.

Call, write or check reader circle number for additional information. Only \$125. Phone orders accepted with Mastercard or Visa numbers.

**Dealer and Distributor  
Inquiries Invited.**



**MYLSTAR  
ELECTRONICS  
INC.**

165 West Lake Street  
Northlake, Illinois 60164  
Tel (312) 562-7400

©1984 Mylstar  
All rights reserved

**A Unit of The Coca-Cola Company**

CIRCLE NO. 167 ON READER SERVICE CARD

## RELAY

tems that also are running Relay. A file containing special instructions is created to control the way Relay interacts with callers in this mode.

Multiple levels of access to system disks provide flexible operating conditions for a wide range of callers.

The file may contain some or all of the following items:

LOGMSG=logon message filename (the file may contain any message that all callers should see when they log in)

HELP=help message filename (the file to be displayed when a caller asks for help by pressing the <f10> key)

PW=password (a general log-on password that allows callers to read and write whatever disks are specified upon entry to the unattended mode)

MASTER=password (allows access to all disks regardless of access limitations imposed on general callers)

READONLY=password (allows callers to read from but not write on the disks that are made available by the access level specified)

Relay also will keep a printed record of all transactions and commands during unattended mode if the printer is on and if the user has not disabled the logging option.

### **FULL SCREEN EDITOR**

In addition to all of the sophisticated communications functions in Relay, the product also has a decent full screen editor. The file being edited must reside completely in memory, along with DOS, the communications functions, and anything else that's memory-resident. The editor is essentially command-driven, although the function keys duplicate some of the available editing commands.

The display is a viewport onto a text scroll that is up to 240 characters wide and as many lines long as available memory will permit. The viewport may be moved right or left

in increments of 80 columns, and the cursor may be moved anywhere on the screen by using the arrow keys. It may take some practice to use this editor effectively, because the screen does not scroll up when the user tries to move the cursor off the bottom of the screen; instead, the cursor wraps back to the top line. Other commands scroll the screen and page up and down through the file, moving a screen or half-screen at a time. Photo 3 shows a sample editing session in progress.

### **EXECUTING COMMANDS**

To use another editor rather than the one provided, the user can escape to the ONLINE menu and use the "Run Program" function—<F8>—to call in the preferred program, providing there is enough memory available. Photo 4 is an example of how to execute a DOS 2.0 (or later version) resident command (such as TYPE, DIR, etc.).

In fact, pressing <F8> from either the ONLINE or OFFLINE menus lets the user execute most command/program files (.COM and .EXE). This function worked perfectly with all of the text editors I tried (EDIX, VEDIT, and WordStar in the nondocument mode), with VisiCalc (a supplied program called VL80.COM must be run first), and with numerous other applications.

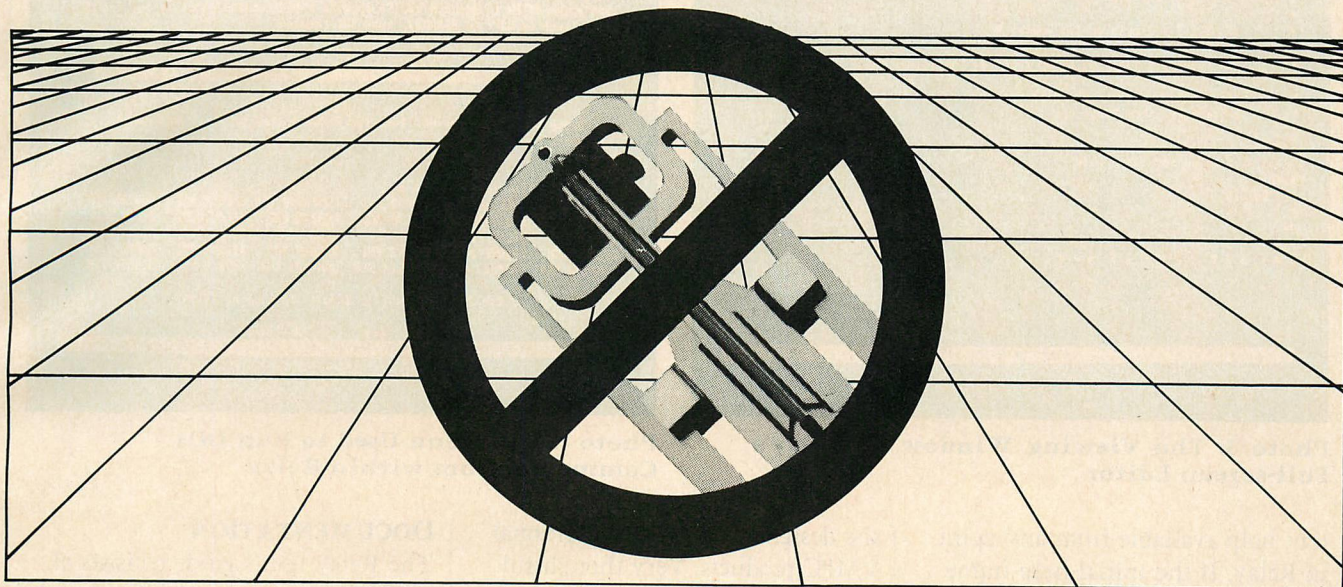
### **ON-LINE HELP**

The help feature of Relay is one of the most extensive available in a microcomputer product of this type. Help frames are context sensitive and are actually helpful. The user's guide claims that once a user is familiar with the help system, he will seldom need to refer to the guide. It's true. I was able to find appropriate and complete information for nearly every situation encountered in the use of Relay.

Photo 5 shows the detailed and relevant help provided during the modem-selection activity of initialization. It is indicative of the excel-



# No Head is Better than One!



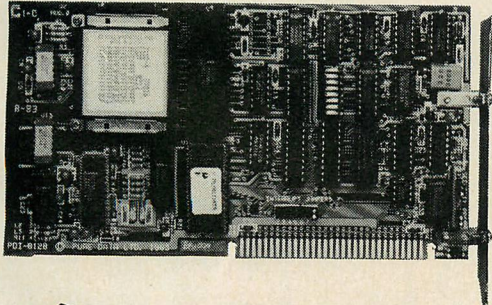
## Bubble Storage for the PC and PC XT.

Bubble memory combines the best features of disk and solid state memory with extreme reliability. Unlike a floppy disk, it's entirely solid state with no moving parts. This makes it impervious to dust, dirt, fumes, and vibration. And, unlike normal memory, it doesn't lose data when the power goes off.

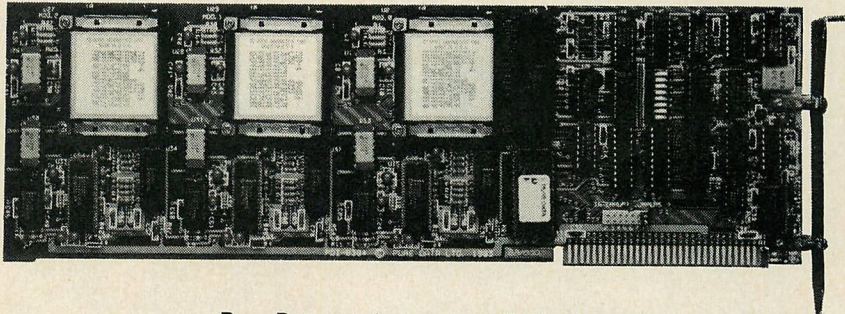
Now you can enjoy all the advantages of bubble memory combined with the famous Pure Data quality and reliability for your IBM PC or XT.

- PDIB-128 provides 128 KBytes in one slot
- PDIB-384 provides 384 KBytes in one slot
- Not affected by power failure
- Faster than a floppy disk
- Extremely reliable
- Standard DOS 2.0 disk-type device
- Compatible with all DOS software
- No patching of any system files
- Password option for computer and/or bubble
- Password cannot be bypassed by software
- Comprehensive diagnostics and other utilities
- Fully illustrated installation and operation manual
- Technical support hot-line
- Guaranteed 48 hour service
- Bubble uses 2 I/O addresses and no memory space
- Interrupts are supported but not required
- DMA is supported but not required
- On-board EPROM socket
- Pure Data quality and reliability
- No moving parts

PDIB-128



PDIB-384



**Pure Data Ltd**

860 Denison Street,  
Markham, Ontario, Canada L3R 4H1

☎ (416) 475-2424 ☎ (416) 498-1616

Pure Data products are available through.



**OnTrak**

1335 Valwood Parkway, Suite 108,  
Carrollton, Texas 75006

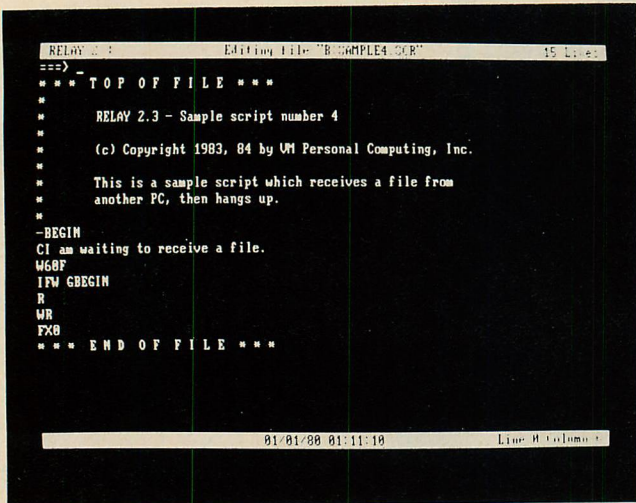
**DATA SYSTEMS** Telephone (214) 620-8000  
P.O. Box 815155, Dallas, Texas 75381

Highland Computer Corporation, Keysoft International,  
Computerland, Computer Innovations, Compugroup,  
ECOSEA Technologies and others.

IBM is a registered trademark of International Business Machines Corporation.

CIRCLE NO. 190 ON READER SERVICE CARD



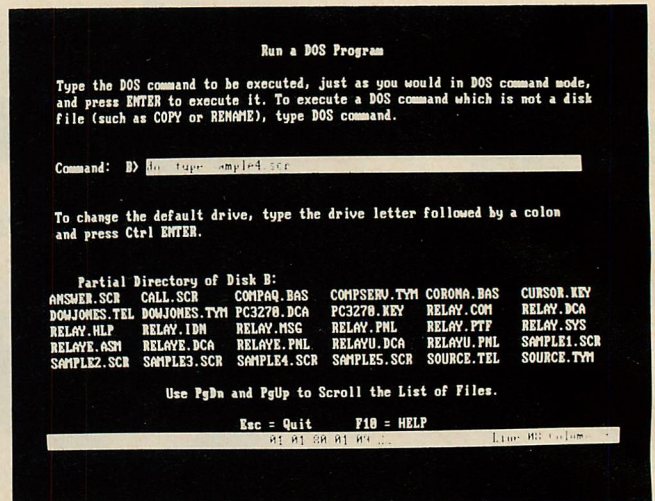


**Photo 3: The Viewing Window of Relay's Full-screen Editor**

lent help available from any point in Relay. If the initial help frame doesn't give adequate information, more detailed ones are accessible by typing <PgDn>.

Relay even has an on-line feedback form that can be printed and filled in to report bugs, congratulate

the designers, and order additional VMPC products. Very thoughtful. Most products have either no such forms or only one printed copy in the manual. VMPC gives you an electronic master that can be printed out as often as necessary. And they encourage its use.



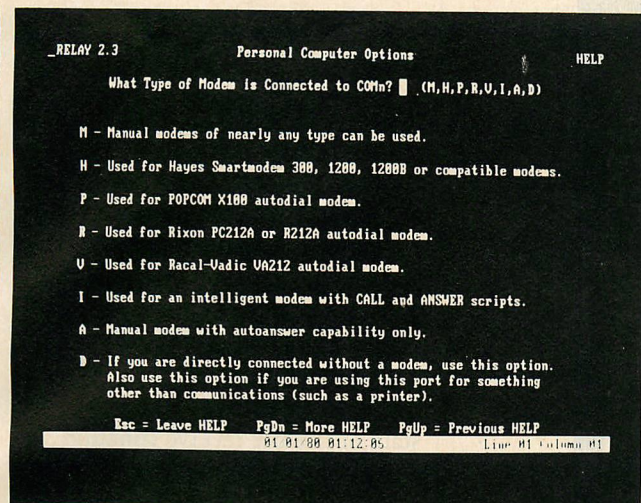
**Photo 4: The Menu Used to Run DOS Commands from within Relay**

## DOCUMENTATION

The Relay user's guide consists of about 250 pages of typeset material in a half-size ring binder. The coverage is complete and well organized, and the writing is clear and well illustrated. The index is accurate but not complete enough.

BY THE TIME  
YOU DISCOVER  
A WORK OUT  
DISK, IT'S PROBABLY  
TOO LATE.





**Photo 5: A Help Frame Called from the Modem-selection Menu**

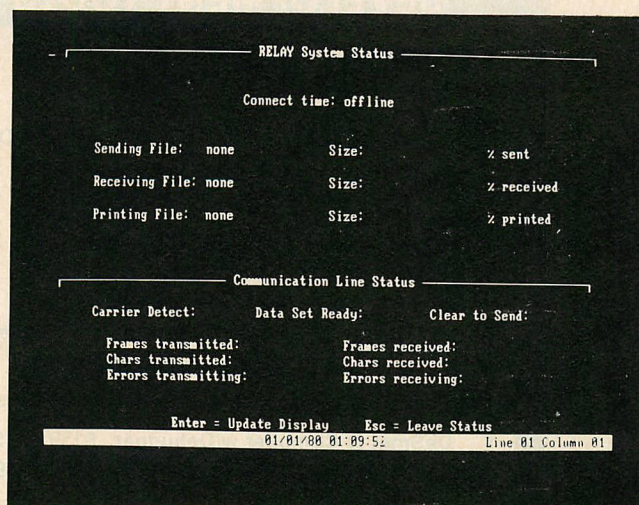
Much of the material covered in the user's guide is also available on-line, except for the examples and illustrations. It was easier on occasion to find what I needed by going into the program and pressing the help key, <F10>. That will not work for the programs that are sup-

plied with Relay in separate files. It's a good idea to read through the manual once to get an idea of the abilities of the product.

#### **SUMMARY**

This program makes me question my long-standing uneasiness about

menus, probably because Relay's menu tree is rather broad and flat. It is never necessary to descend more than one or two levels to get to a place where work can be done, and it is possible to jump directly to the status screen (photo 6) and help frames at any time.



**Photo 6: The Relay System Status Screen**

## **Presenting the No-Risk Disk.™**

No matter how many times you play it, the TDK No-Risk Disk won't drop a letter. A word. Not even a bit. We guarantee it.

And not for 1 year. Or 5 years. But with a lifetime replacement warranty for as long as you own the disk.

That's a promise we don't make lightly. Because it has almost 50 years' research and development of TDK recording products behind it.

So the next time you want to store important information, put it on TDK. You've got nothing to lose.



TDK offers a complete line of the most popular disks in 5¼- and 8-inch formats.

# **TDK. THE NO-RISK DISK.™**

CIRCLE NO. 178 ON READER SERVICE CARD



# PROGRAMMER'S DEVELOPMENT TOOLS

## IBM Personal Computer Language and Utility Specialists

### LANGUAGES:

	List	Ours
C-86 Computer Innovations .....	\$395	319
C Programming System by Mark Williams	500	459
Lattice C Compiler .....	500	299
Professional BASIC Morgan Computing	345	295
ADA-86 + Tools Janus .....	700	499

Call for Microsoft and Digital Research Products.

### \*\*\*\* "C" Language Starter Kit \*\*\*\*

Package Consists of: List Ours

DeSmet C Compiler w/Debugger	\$159	145
Windows For C Creative Solutions	150	119
C Programming Language book by K & R	25	20

Retail \$334, Priced Separately \$284

**Our Special Package Price! \$269**

Greenleaf Utilities available for DeSmet C.  
Call for Details and Prices.

**We have in-staff APL expertise!**

### \*\*\*\* STSC APL\*Plus/PC \*\*\*\*

This powerful, interactive, fourth-generation language includes a tutorial, help system and useful extensions. Comes with plug-in APL character generator chip.

Retail \$595 Our Normal Price \$540

**Special Sale Price! \$469**

Send for complete demonstration package \$5

### UTILITIES:

C Functions Library by Greenleaf ....	175	159
Btrieve by SoftCraft .....	245	205
Communications Library by Greenleaf .....	New	160
Trace-86 by Morgan Computing .....	125	115
OPT-TECH Sort High Performance Utility.	99	87
Profiler by DWB & Associates .....	175	149
AKA ALIAS by Soft Shell Technology .	60	57
Plink-86 Overlay Linkage Editor .....	395	315
Panel Screen Design/Editing by Roundhill .	350	259
FirsTime Intelligent C Text Editor by Spruce	295	CALL
Halo Color Graphics for Lattice, CI-86 ....	200	159
Windows for C by Creative Solutions .	150	119

### \*\*\*\* A SOLID GOLD VALUE \*\*\*\*

**CodeSmith-86 Debugger**

Version 1.8 by Visual Age

Retail \$145, Our Normal Price \$129

**Special Sale Price! \$109**

Prices are subject to change without notice.

Account is charged when order is shipped.

**CALL FOR LOW PRICES**



**1-800-336-1166**



**Programmer's Connection**  
281 Martinel Drive  
Kent, Ohio 44240  
(216) 678-4301 (In Ohio)


**"Programmers Serving Programmers"**

CIRCLE NO. 226 ON READER SERVICE CARD

## RELAY

Data capture to a printer is supported in the usual ways—pressing <Ctrl>-<PrtSc> toggles the printer ON/OFF, and pressing Shift-<PrtSc> prints the current contents of screen memory. The Relay package supports data capture directly to disk using its file-receive function. After specifying the receiving file, the user may toggle the data capture ON/OFF by pressing <F4>. A message on the 25th line of the screen indicates the current state of the file-receive function.

User support is reportedly very good. VMPC continually improves and expands its products and provides an on-line capability for registered users to obtain the latest patches, called PTFs (program temporary fix). These are downloadable programs that, when executed, modify the Relay load module, RELAY.COM, to incorporate bug fixes and program upgrades; these programs also update a disk file called RELAY.PTF that contains the latest list of applied PTFs.

Users who want a reasonably priced, feature-packed communications package for their computers should give this one a serious look. The more I use it, the better I like it—it's proving to be a real productivity tool. I'll like it even more when the quality of the terminal-emulation feature is on a par with the rest of the program. 

*Relay, Version 2.3*

VM Personal Computing, Inc.

475 5th Avenue, Room 411

New York, NY 10017

212-686-1450

Language: Macro Assembly Language

List: \$149

CIRCLE 491 ON READER SERVICE CARD

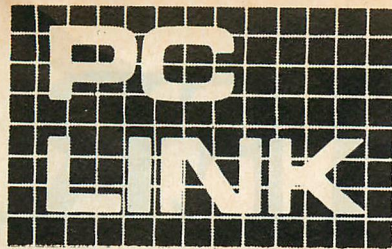
## References

Loomis, Mary E. S., *Data Communications*, Prentice-Hall, 1983.

McNamara, John E., *Technical Aspects of DATA Communication*, Digital Press, 1977.

X.25, "Computer Communication Review," vol. 10, nos. 1 and 2 (January/April 1980).





# INDEPENDENT STORE IN NYC DEDICATED TO IBM® PC SOFTWARE AND PERIPHERALS ONLY

BY APPOINTMENT WE DEMONSTRATE MOST OF THE PRODUCTS WE SELL.

STORE HOURS: 9:00 A.M. - 5:30 P.M. E.S.T. MON. - FRI.

Saturdays 10 A.M. - 4 P.M.

Terms, conditions and prices differ in our store.

**PC LINK, CORP.** 29 WEST 38TH ST. 2ND FL., NEW YORK, NY 10018

## SPECIALS OF THE MONTH

CIRCLE NO. 183 ON READER SERVICE CARD

### AST MEGAPLUS II

Clock/Serial/64K ..... 259.00

#### BUSINESS SOFTWARE

##### ALPHA SOFTWARE

DATA BASE MANAGER II ..... \$205.00  
EXECUTIVE PACKAGE ..... 109.00  
TYPE FACES ..... 89.00

##### ASHTON-TATE

dBASE III ..... CALL  
FRAME WORK ..... CALL

##### CONTINENTAL

HOME ACCOUNTANT PLUS ..... 89.00  
TAX ADVANTAGE ..... 45.00  
PROPERTY MANAGEMENT ..... 319.00

##### ENERTRONICS

ENERGRAPHICS ..... CALL

##### FOX & GELLER

D. GRAPH/QUICKCODE/DIUTIL ..... CALL  
OZ ..... CALL

##### FRIENDLYSOFT

FRIENDLY WRITER ..... 60.00

##### HARVARD SOFTWARE

HARVARD PROJECT MANAGER ..... CALL

##### HAYES

SMARTCOM II ..... 95.00

##### INNOVATIVE SOFTWARE

TIM IV ..... CALL

##### I U S

ACCOUNTING AR/AP/GL ea ..... CALL  
INVENTORY CONTROL ..... CALL  
ORDER ENTRY ..... CALL  
PAYROLL ..... CALL  
EASY WRITER II/SHELLER/MAIL ..... 199.00  
EASY FILER ..... 199.00  
EASY PLANNER ..... 159.00

##### LOTUS DEVELOPMENT CORP.

LOTUS 1-2-3. (No Mail Or Phone Orders) ..... CALL  
SYMPHONY (No Mail Or Phone Orders) ..... CALL

##### MICRO DATA BASE

KNOWLEDGE MAN ..... CALL

##### MICRO PRO

INFOSTAR ..... CALL  
WORDSTAR PROFESSIONAL. SEE SPECIAL

##### MICRORIM

R BASE 4000 ..... 309.00  
EXTENDED REPORT WRITER ..... 109.00  
CLOUT (RE8.256K) ..... 139.00  
PROGRAM INTERFACE ..... 295.00

##### MICROSOFT

MULTIPLAN ..... 139.00  
WORD ..... CALL  
COMPILERS ..... CALL

##### MICROSTUFF

CROSSTALK ..... 105.00

##### NORTH AMERICAN BUSINESS

MEMORY SHIFT ..... 69.00

##### NORTON COMPUTER

NORTON UTILITIES ..... 55.00

### MICROPRO

WORD STAR Professional ... 269.00

#### PC SOFTWARE

CREATABASE ..... 65.00

##### PEARL SOFT

PERSONAL PEARL ..... CALL

##### ROSE SOFT

PROKEY 3.0 ..... 85.00

##### STSC

APL\*PLUS ..... CALL

##### SATELLITE SOFTWARE

WORD PERFECT ..... 269.00

##### SAWHNEY SOFTWARE

TAX MODE ..... CALL  
PLAN MODE ..... CALL

##### SOFTWARE ARTS

TK SOLVER ..... 249.00  
FINANCIAL MANAGEMENT ..... 79.00  
MECHANICAL ENGINEERING ..... 79.00

##### SOFTWARE PUBLISHERS

PFS SERIES ..... CALL

##### SOFTWARE SYSTEMS INC.

MULTIMATE ..... 279.00

##### WARNER SOFTWARE

THE DESK ORGANIZER ..... 209.00

##### DISK DRIVES

IOMEGA BERNOULLI BOX ..... CALL  
QUME T142 ..... CALL  
SYSGEN ..... CALL  
TANDON TM 100-2 ..... 200.00

##### MULTIFUNCTION BOARDS

64 RAM CHIPS ..... 55.00  
AST CARDS ..... CALL  
QUADBOARD CARD ..... CALL  
AMDEK MAI CARD ..... CALL  
PC MOUSE ..... CALL  
FTG LIGHTPEN ..... CALL  
PLANTRONICS COLOR PLUS CARD ..... CALL  
HERCULES ..... CALL  
HELIX BUBBLE MEMORY ..... CALL

##### ENTERTAINMENT & EDUCATION

ACROSS THE USA ..... 25.00  
ATI TRAINING PACKAGES ..... ea. 55.00  
ATTACK ON ALTAIR ..... 29.00  
BIG TOP ..... 27.00  
CONQUEST ..... 29.00  
COSMIC CRUSADERS ..... 27.00  
DEADLINE ..... 37.00  
DIGGER ..... 29.00  
THE EXTERMINATOR ..... 29.00  
FLIGHT SIMULATOR-NEW VERSION ..... 35.00  
FRIENDLY ARCADE ..... 29.95  
FRIENDLY PC INTRO SET ..... 29.95  
FROGGER ..... 25.00  
GORGON ..... 29.00  
HI RES #4 ..... 27.00  
KID STUFF ..... 32.00  
MASTER MINER ..... 27.00  
MOON BUGS ..... 29.00  
MY LETTERS, NUMBERS & WORDS ..... 32.00  
PC CRAYON ..... 39.00

### BROTHER

HR-25 ..... 659.00

#### PC TUTOR

PLANET FALL ..... 49.00  
SERPENTINE ..... 39.00  
SNACK ATTACK ..... 25.00  
SPINNAKER SERIES ..... 27.00  
STYX ..... CALL  
SUSPENDED ..... 29.00  
WITNESS ..... 39.00  
WIZARDRY ..... 39.00  
ZORK I, II, III ..... ea. 27.00  
ZURAN DEFENDER ..... 25.00

#### ACCESSORIES

CURTIS PRODUCTS  
DISPLAY PEDESTAL ..... 35.00  
MONO CABLE ..... 38.00  
KEYBOARD CABLE ..... 30.00  
SYSTEM STAND ..... 17.00  
COLOR CABLE ..... 45.00  
SURGE PROTECTORS ..... CALL  
KRAFT JOYSTICK ..... 39.00  
HAYES MACH III JOYSTICKS ..... 45.00  
KEYBOARD DRAWER ..... 75.00

#### MONITORS

AMDEK 310A ..... \$175.00  
COLOR II+ ..... CALL  
PRINCETON GRAPHIC HX-12 ..... 479.00  
SR-12 ..... CALL  
MAX-12 ..... 179.00  
ZENITH RGB MONITOR ..... 479.00

#### MODEMS

HAYES SMART MODEM ..... \$205.00  
HAYES SMART MODEM 1200 ..... 489.00  
HAYES SMART MODEM 1200B ..... 449.00

#### DISKETTES

DYSAN  
S.S./D.D. ..... \$24.00  
D.S./D.D. ..... 34.00  
MAXELL  
S.S./S.D. ..... 23.00  
D.S./D.D. ..... 33.00  
VERBATIM (5 year warranty)  
21144 HEAD/CLEAN KIT ..... 10.50  
S.S./D.D. ..... 22.00  
D.S./D.D. ..... 32.00  
WABASH (Lifetime Warranty)  
D.S./D.D. ..... 25.00

#### PRINTERS

DIABLO 630 ..... \$1699.00  
DIABLO 630 TRACTOR FEED ..... 249.00  
DYNAX DX-15 ..... CALL  
IDS PRISM 132 COMPLETE ..... 1499.00  
OKIDATA 92P ..... CALL  
93P ..... CALL  
84P ..... CALL  
TOSHIBA P1351 ..... 1289.00  
EPSON FX SERIES ..... CALL  
NEC 3550 ..... 1599.00  
PRINTER CABLE/PARALLEL ..... 25.00

**CALL TOLL FREE 800-221-0343**

All prices listed in this ad are effective Oct. 1-31, 1984. All Brands are Registered Trademarks. IBM is a Registered Trademark of IBM Corp.

**IN NEW YORK CALL 1-212-730-8036**

#### TERMS AND CONDITIONS

We reserve the right to repair, replace or return to manufacturer for repair, all goods acknowledged faulty or damaged on receipt by customer. **Customer must call for Return Authorization Number before returning any goods.** Prompt attention will be given to all damaged and faulty returned goods. Any goods returned for credit are subject to 10% restocking charge, plus shipping charge. No returns for credit on any software. Customer must deal with the manufacturer directly if the customer finds any false claims made by

the manufacturer. All goods are shipped U.P.S. only. Add 2% of price, or minimum of \$3.00 for shipping. Shipping charges on Printers & Accessories vary. We do not ship C.O.D. Please allow one to two weeks for personal or corporate checks to clear. To expedite shipping send money order, certified cashier's check, or charge to your **VISA, MasterCard, WE DO NOT Add a Service Charge For Credit Card Usage.** Prices subject to change without notice. NOT RESPONSIBLE FOR TYPOGRAPHICAL ERRORS.



TOGETHER,  
STOPPING  
YOU.





# THERE'S NO

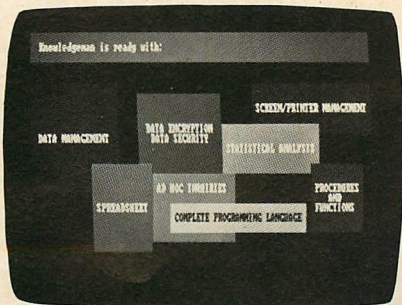
## **KnowledgeMan™ and You. The possibilities are endless.**

To succeed in business, you need a partner that's fast, flexible, intelligent and easy to work with. A partner that can help turn your big ideas into well-conceived reality. One that gives you the support you need to make critical decisions confidently.

No partner can give you more of what you need than KnowledgeMan, the knowledge management software from MDBS.

## **A powerful partner.**

KnowledgeMan helps you manage more knowledge, in more ways, than ordinary software. It can help you make better decisions on just about everything from production scheduling to market



forecasting. KnowledgeMan and its optional components offer data management, spreadsheet analysis, statistical analysis, text processing, forms management, business graphics, programming and more.

The key to KnowledgeMan's versatility is its exclusive synergistic integration, allowing you to accomplish your computing needs within one program. Unlike other software, there's no need to exit one function before entering another. The result: different kinds of processing can be intermingled. Quickly and easily.

## **A partner that speaks your language.**

For all of its power and sophistication, KnowledgeMan is remarkably simple to understand. Even a beginner can start putting KnowledgeMan to work in minutes. With a single query, you can obtain related data from unlimited multiple tables. You can even teach KnowledgeMan to understand your own jargon.

## **A partner that helps you along.**

The on-line HELP facility allows you to draw on 6800 lines of helpful information organized into 380 screens. If you have a problem or question, KnowledgeMan allows you to access the pertinent HELP screen immediately. Each screen is carefully designed to provide a quick reference guide to KnowledgeMan commands.

## **A partner that gives you room to grow.**

Ordinary software packages can be frustratingly easy to outgrow. Not KnowledgeMan. Each KnowledgeMan component has more power than you'll probably ever need—far more than conventional integrated programs. With KnowledgeMan, you don't sacrifice capability, capacity or convenience. So with KnowledgeMan, you spend your time solving problems—not trying to overcome software limitations.

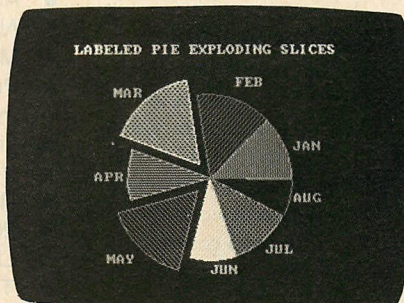
## **A partner that protects your interests.**

KnowledgeMan offers sophisticated security features. Unauthorized access to data is next to impossible, thanks to password checking, thousands of access code combinations and data encryption.

So your secrets are safe with KnowledgeMan.

## **A partner you can build on.**

To add yet another dimension to KnowledgeMan's capabilities, you can get fully-integrated options like K-Graph, an extensive business graphics facility that



lets you plot information in a variety of colorful graphs, charts and diagrams. For text processing, the K-Text option lets you incorporate data into written documents quickly and easily. Or, create highly-polished, full-color customized forms with K-Paint, our forms painting option. To short-cut the keyboard, put the K-Mouse option to work.

## **A partner you should get to know better.**

To see KnowledgeMan in action, visit your dealer. Or contact Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902, (317) 463-2581, Telex: 209147 ISE UR.

It may be the beginning of a long, successful partnership.

Current version is 1.07 as of 9/10/84. KnowledgeMan, K-Graph, K-Paint, K-Text, and K-Mouse are trademarks of Micro Data Base Systems, Inc. MDBS is a registered trademark of Micro Data Base Systems, Inc.

# KNOWLEDGE man™

The Knowledge Management Software  
from MDBS



# What do IBM, HP, Tektronix, and DEC have in common? **TBASIC!**

**TBASIC.** A new, portable, incrementally compiled language with integral GPIB and Graphic statements compatible with Tektronix 4050A BASIC.

## Graphics Galore

TBASIC gives you over 60 high level graphic commands for a variety of graphic computers and terminals. From IBM PC to high resolution Tektronix terminals, TBASIC lets you access their intelligent features consistently and with a minimum of effort.

## GPIB Genius

Instrument control and operation of shared peripherals does not need to be awkward. TBASIC provides syntax for both simple access of GPIB devices through normal I/O commands that understand GPIB, and special purpose functions for sophisticated instrument control.

## For Professionals and Part-timers

TBASIC is an excellent development language for general purpose or technical programs. It is extremely easy to learn and use with features that professional and novice programmers alike will find useful for applications ranging from business to scientific.

## TBASIC Triumphs

No other high level language gives you complete access to and control over all elements of your computer system like TBASIC does. No other language gives you so many advanced and useful features.

## Features Fantastic

- Graphics: over 60 functions and commands
- GPIB access is incorporated into standard I/O statements
- Tektronix 4050A BASIC programs are compatible
- Incremental compilation produces fast intermediate code
- Interactive nature of BASIC is fully preserved
- Automatic line numbering with optional line increment
- Abbreviated line entry format (3 letters/keyword)
- Multiple statements per line are supported
- Program listings are neatly formatted with indented loops
- Instant syntax checking "shows" you errors
- Line editor with 7 function keys
- Variable names can be up to 31 characters long
- Rename variables in programs without editing
- 20 special function "user definable keys"
- Line labels are supported for structured programming
- True subprograms with local or global variables
- 15 digit precise decimal floating point arithmetic
- Integer data types conserve memory and speed execution
- 8087 math coprocessor supported
- All math functions can operate on arrays
- Matrix operations are included
- Boolean, logical, and binary operators are supported
- Relational operators allowed in math expressions
- Device independent I/O scheme
- Random and Sequential file types
- INPUT statements allow prompts on same line
- Debug facilities include numerous trace options
- Single step function key for manual program execution
- Complete error trapping and handling is provided

## Superior Support

### Computers:

IBM PC/XT, HP-150,  
Tektronix 4100 Series,  
DEC VAX, and others

### Operating Systems:

MS-DOS, PC-DOS, CPM,  
UNIX, VMS,...

### GPIB Interface Cards:

National Instruments,  
Ziatech,...

### Graphic Cards:

IBM, Hercules,...

### Graphic Terminals:

Tektronix, Seiko,...

### Plotters:

Cal-Comp, Hewlett-  
Packard, Houston  
Instruments, Tektronix,...

These and many other popular computers, operating systems, and peripherals are, or will be supported by TBASIC.

IBM PC and other micro versions of TBASIC are priced at \$795.

A supermini version of TBASIC is available for DEC VAX at \$2000.

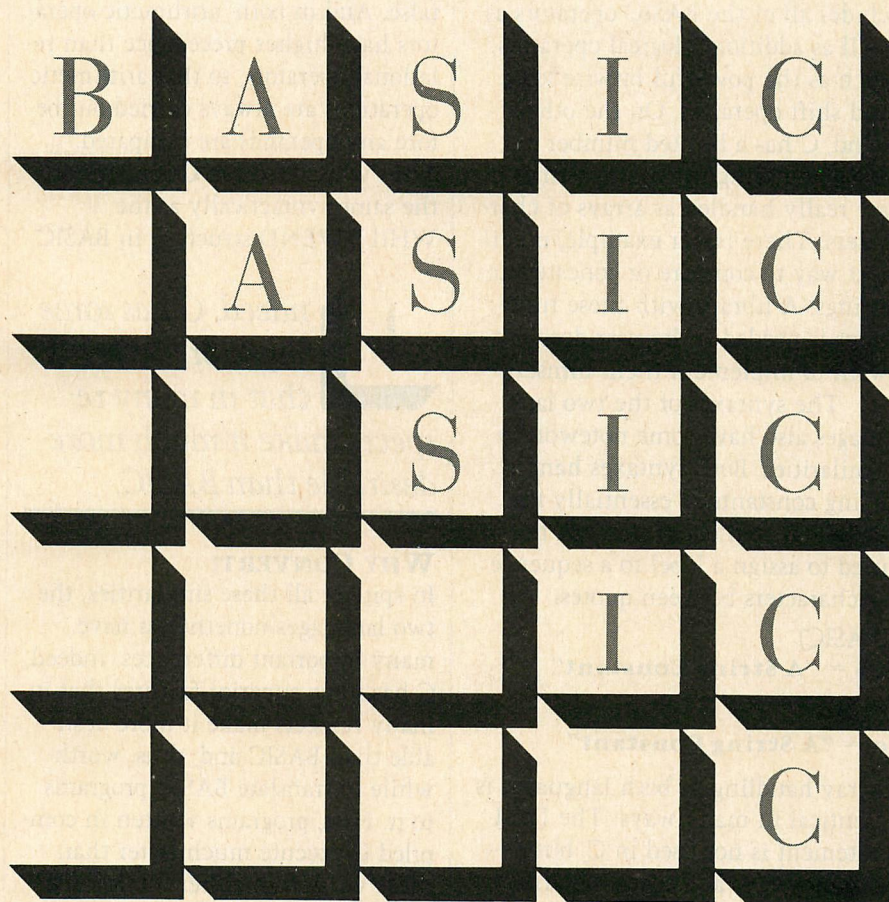
Call 1-801-224-6550 to order your copy of TBASIC now. Further information and demonstrations are available upon request.

TransEra Corporation  
3707 North Canyon Road  
Provo, Utah 84604



**TransEra**





# BASIC TO C

**T**wo products that ease the transition from BASIC to C

Largely because of its greater portability, speed, and power, C is rapidly replacing BASIC as the favored language for many new software products. Some software developers are translating their programs from BASIC into C. A number of tools have emerged to help in the cross-over between BASIC and C. Two of these tools—BASIC\_C, a library of BASIC functions for several popular C compilers, and BASTOC, a BASIC to C translator that produces C source from BASIC text files—are evaluated in this article.

## **BASIC vs. C**

At first glance, the differences rather than the similarities between

C and BASIC are the most obvious. C is always compiled; BASIC is generally an interpreted language. C is structured; BASIC is not. C supports user-defined multi-lined functions, while BASIC is limited to a fixed vocabulary. C usually adheres strictly to the lower-case format, whereas in BASIC, which accepts both upper and lower case, reserved words usually appear in upper case.

C has a far richer set of operators, allowing for its well-known ability to express complex logical

---

*Ernest Tello is the cofounder and director of research and development of a consulting and software firm called Integral Systems. He has a master's degree in engineering science from Rensselaer Polytechnic Institute.*



operations very concisely. C includes all of the BASIC operators as well as additional logical operators, such as the powerful bitwise logic and shift operators. On the other hand, C has a limited number of string-handling functions: strings are really handled as arrays of characters. There is, for example, no direct way to compare or concatenate strings. A library with these functions is needed if the user does not want to implement them himself.

The syntaxes of the two languages also have some noteworthy similarities. Both syntaxes handle string constants in essentially the same way. An equal sign can be used to assign a label to a sequence of characters between quotes.

(BASIC)

**Q\$ = "A String Constant"**

(C)

**q = "A String Constant"**

Array handling in both languages is identical in many ways. The DIM statement is not used in C, but declaring arrays and accessing array elements use essentially the same conventions of parentheses and indexing numbers.

Array declarations:

(BASIC)

**DIM A(1,2,3,4)**

**DIM A\$(7)**

(C)

**float a[1][2][3][4];**  
**char a[7];**

Accessing first array element:

(BASIC)

**A(0,0,0,0)**

**A\$(0)**

(C)

**a[0][0][0][0]**  
**a[0]**

The same syntax is used for initializing and assigning variables, and single-precision floating-point numbers appear the same in both languages. The arithmetic operators, except for a few minor exceptions, are essentially identical. In both BASIC and C any nonzero operand

is considered true; a zero operand is false. And in both, arithmetic operators have higher precedence than relational operators, so that arithmetic operations are always carried out before any operands are compared. The "while" loop in C is essentially the same syntactically as the WHILE-WEND structure in BASIC.

**I**ndeed, C has some superior features that in many respects make it much more desirable than BASIC.

## WHY CONVERT?

In spite of all these similarities, the two languages nonetheless have many important differences. Indeed, C has some superior features that in many respects make it more desirable than BASIC and, thus, worthwhile to translate BASIC programs to it. First, programs written in compiled C execute much faster than those written in either interpreted or compiled BASIC.

The advantages of C are not confined to speed, however. C enables the user to perform many tasks that simply cannot be done in BASIC. It is not just that C is a structured language that allows calls by name to newly improvised functions. With C's advanced pointer capabilities, for example, pointers to functions can be used. Thus, when separate routines are needed for different data types, they can be included in the same function and selected by pointers passed to the function when it is called.

## AREAS OF DIFFICULTY

In making the change from BASIC to C, the programmer will have to master five tasks in addition to the C syntax. These are:

1. The compiling and linking environment
2. Structured programming practice
3. The complex set of C data types

4. The powerful uses of pointers in C

5. Learning to write functions.

As in any compiled language, once the C source code has been prepared with an editor, the source file must be passed through a compiler, which generates an object file of machine code. A linker must then be used to create a loadable and executable .EXE file. Learning the option parameters and correct syntax acceptable to the compiler and linker is a skill developed through experience.

In BASIC, the GOTO and GOSUB statements allow the user, in theory, to branch to any line number or subroutine anywhere in the program. He will, however, pay a considerable penalty in program speed and efficiency for lavish use of these unstructured branching functions. Structured programming involves careful design of the various segments of a program, according to the rules of the language, so that greater efficiency is possible. Although C offers a "goto" function, experienced C programmers seldom use it. Learning how to dispense with GOTOs and GOSUBs is one hurdle a BASIC programmer must jump when he is migrating from BASIC to C.

The C language is known for its large set of data types. Although some of these are much the same as the corresponding BASIC data types, some are entirely different and must be learned. C and BASIC have three data types in common: 2-byte integer variables; 4-byte single-precision floating-point variables; and 8-byte double-precision variables. In addition, C has seven other data types: auto, char, extern, long, short, register, and static. A variable must always be declared with its designated data type. If it is declared in the C preprocessor, it is global to the whole program. If it is declared in a function definition, then it is local to that function. For more information on the unique C data



types, consult one of the books recommended below.

With C, pointers come into focus as a programming technique that allows greater generality and compactness. A pointer is really nothing more than a variable that can hold the address of another variable. This additional dimension of variability gives another dimension of power. By using routines that manipulate the values of pointer variables, alternate variables can be passed to functions. Pointers can also be used as pointers to array elements. In general, anything that arrays can do, pointers can do faster. Also, arrays of pointers can be constructed and have many uses, such as in rapid sorting routines. Pointers play only a minor role in BASIC, but C is a language that almost appears to have been invented for the purpose of compact and powerful pointer manipulation.

Perhaps the most dramatic difference between C and BASIC derives from the fact that in C the programmer can write his own routines that then can be called by name as if they were new words in the language. Unlike a GOSUB routine, this technique allows the programmer to write functions that can

**P**ointers play only a minor role in BASIC, but C is a language that almost appears to have been invented for the primary purpose of compact and powerful pointer manipulation.

be compiled, placed in a library, and called by any C program. Writing these functions is a skill that must be acquired from experience. Thus, a BASIC programmer is unlikely to become proficient in C overnight.

Two software products now on the market are meant to make this

Now With  
Flipscreen

# SYMD

## SYMBOLIC•DEBUGGER

### Faster, easier more productive

*SYMD is a unique new programming aid that dramatically reduces the time and effort needed to identify and correct programming errors. SYMD simplifies debugging by utilizing source code symbols and line numbers wherever an address or offset is required. Flipscreen*

*feature allows separate display, including graphics, for SYMD and program under test. SYMD also lets you: Examine and/or change real number data; assign permanent or temporary breakpoints, including pass counts to control looping; check instruction execution sequences with backtrace commands; use profiling commands to identify the most active*

*parts of a program. And much more. SYMD can be used with compiler or assembly language programs. System requirements: PC-DOS™ or MS-DOS™ 1.1 or 2.0; 192K recommended; 80-column display.*

*SYMD is priced at only \$125. Free literature on request. VISA or MasterCard accepted.*

™MS-DOS is a trademark of Microsoft Corporation.

™PC-DOS is a trademark of the IBM Corporation.

**D+V** Systems

400 Amherst Street Nashua, NH 03063 (603) 881-7140

CIRCLE NO. 131 ON READER SERVICE CARD

## YOU DON'T HAVE TO CRAWL THROUGH MANUALS ANYMORE.

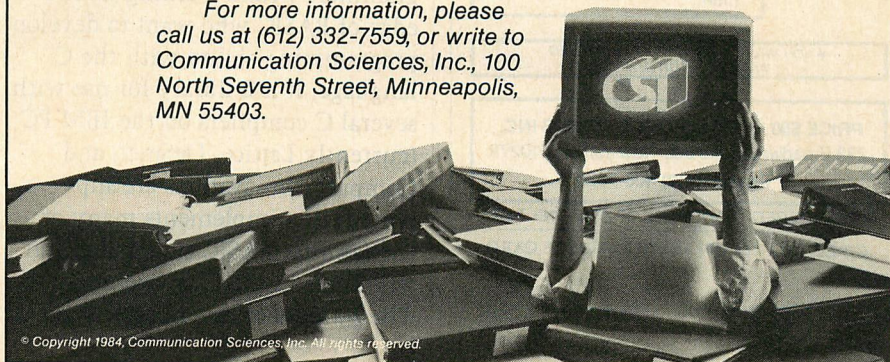
Now you can put them online with Explain™...the documentation system from Communication Sciences, Inc.

CSI's Explain takes you a step beyond the editing/printing cycle used for the traditional manual. With Explain, writers create and update documentation online, as a data base. And they don't have to be programmers to do it.

Once your documentation is online, it can stay online. Readers can get to it with the touch of a key, either directly from your applications or through Explain itself.

User help. Program guides. Procedures. Standards. Put it all online with Explain, the paperless documentation system.

For more information, please call us at (612) 332-7559, or write to Communication Sciences, Inc., 100 North Seventh Street, Minneapolis, MN 55403.



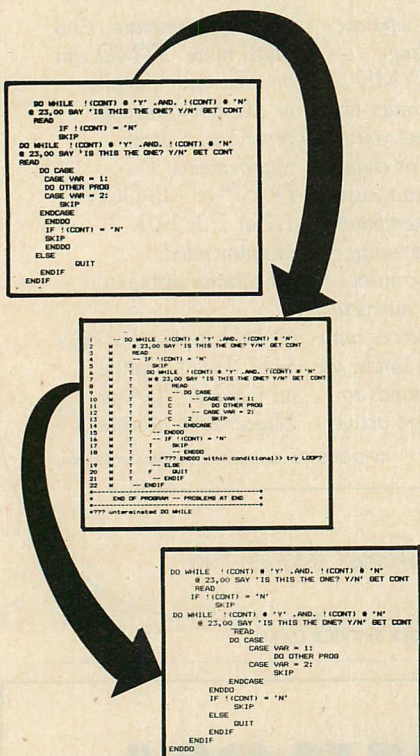
© Copyright 1984, Communication Sciences, Inc. All rights reserved.

CIRCLE NO. 173 ON READER SERVICE CARD



# dBASE II® & III® PROGRAMMERS

**\*Why use dFLOW?**



**\*NOVICE:**  
Points out errors in coding technique and labels the precise location of their occurrence. INSTANT FEEDBACK provides the quickest path to improved technique.

**\*PROGRAMMER:**  
dFLOW your sophisticated and/or lengthy source code and have hard-to-discover typos and logic mismatches uncovered in seconds.

**\*PROFESSIONAL:**  
Free your time for billable and interesting projects by having dFLOW catch basic coding errors during system development.

**\* YOU WILL BE AMAZED AT THE SPEED AND PRECISION OF dFLOW**

**PRICE \$50: WALLSOFT SYSTEMS INC.**  
233 Broadway, Suite 869 New York, NY 10279  
**Phone: (212) 406-7026**

® REGISTERED TRADEMARK OF ASHTON • TATE

CIRCLE NO. 164 ON READER SERVICE CARD

## BASIC TO C

**Table 1: Equivalent Functions of BASIC and BASIC\_C**

BASIC	BASIC_C	BASIC	BASIC_C
ABS	ABS	LPRINT	LPRINT
ASC	ASC	LPRINT USING	LPRINT USING
BEEP	BEEP	LSET	LSET
BLOAD	BLOAD	MID\$ fcn	SUB_STR
BSAVE	BSAVE	MID\$ stmt	MID
CHR\$	CHR	MKD\$	\
		MKIS	MK?
		MKSS	/
		OCT\$	OCT
		ON ERROR	ON_ERR_GOTO
			ON_ERR_HALT
			ON_ERR_PRINT
CLOSE	CLOSE	OPEN	OPEN
	CLOSE_ALL	OUT	OUT
CLS	CLS	PEEK	PEEK
COLOR	COLOR	POINT	POINT
CSRLIN	CSRLIN	POKE	POKE
CVI	\	POS	POS
CVS	CV?	PRINT	PRINT
CVD	/	PRINT USING	PRINT USING
DAT\$ var	GET_DATE	PRINT#	FPRINT
DAT\$ stmt	SET_DATE	PSET	PSET
DEF SEG	DEF_SEG	PUT	PUT
END	END	PUT_NEXT	PUT_NEXT
EOF	AT_EOF	RIGHT\$	RIGHT
ERR	ERR	SCREEN fcn	READ_SCREEN
ERROR	ERROR	SCREEN stmt	SCREEN
FIELD	FIELD	SGN	SGN
GET	GET	SPACE\$	SPACE
	GET_NEXT	in PRINT	in PRINT
HEX\$	HEX	STOP	STOP
INKEY\$	INKEY	STR\$	NUM_STR
	GETKEY	STRINGS	STRING
INP	INP	SWAP	SWAP
INPUT	INPUT	TAB	in PRINT
INPUT#	FINPUT	TIMES\$ var	GET_TIME
INSTR	INSTR	TIMES\$ fcn	SET_TIME
KILL	KILL	VAL	VAL?
LEFT\$	LEFT	VARPTR	STR_NUM
LEN	LEN	WRITE	VARPTR
LINE INPUT	LINE_INPUT	WRITE#	BWRITE
LINE INPUT#	FLINE_INPUT		FBWRITE
LOC	LOC		
LOCATE	LOCATE		
	CRSR_DEF		
	CRSR_OFF		
	CRSR_ON		

Reproduced with permission from C Source Inc. © 1984.

**Note:**  
fcn = BASIC function  
stmt = BASIC statement  
var = BASIC variable

transition easier. The BASIC\_C Library and BASTOC.

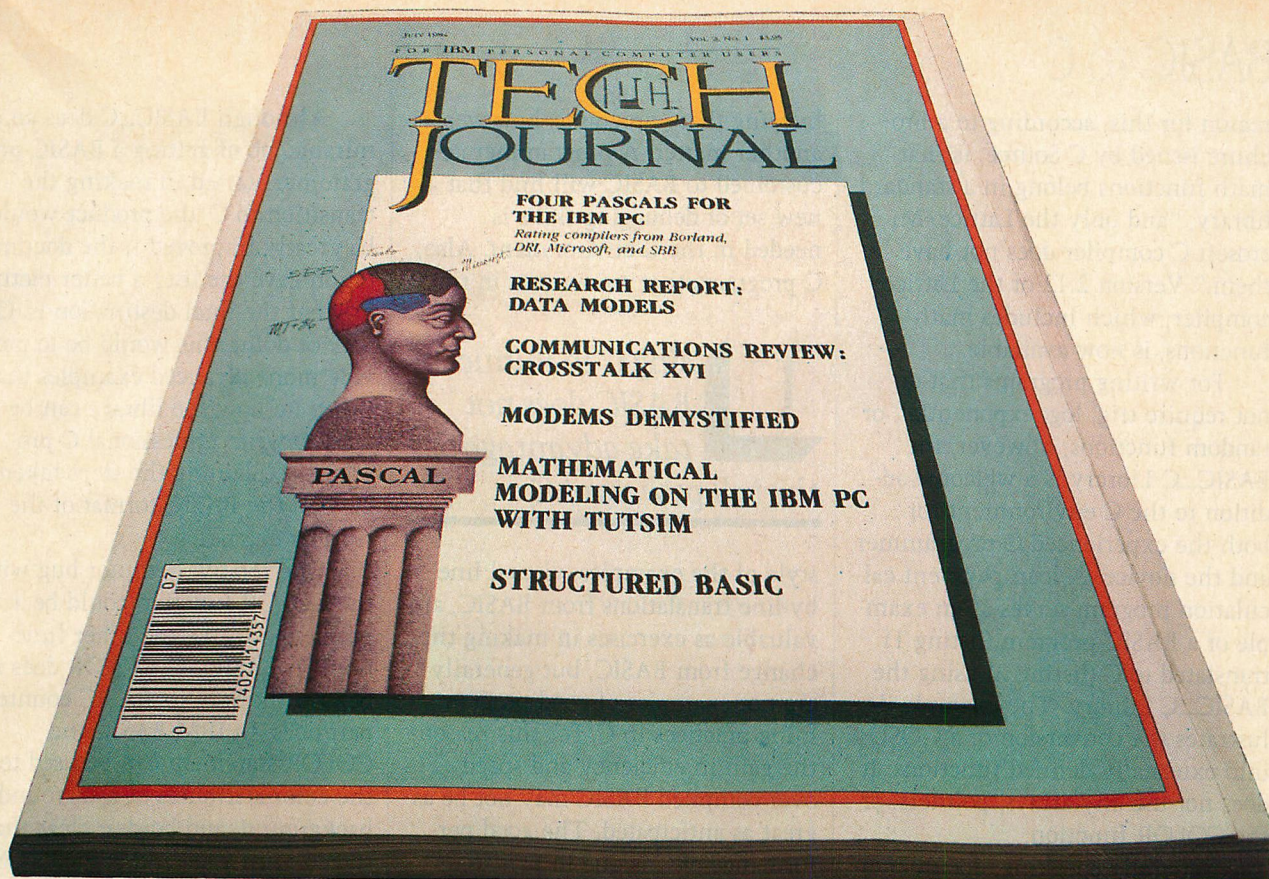
### THE BASIC\_C LIBRARY

C Source Inc. has developed a product intended specifically for programmers with a working knowledge of BASIC who want to develop programming ability with the C language. It is a library for use with several C compilers on the IBM PC (currently Lattice, DeSmet, and Computer Innovations are supported) that implements many of the familiar BASIC statements and structures in the C environment. The purpose of this library is to ease

the process of learning C for BASIC programmers, and to aid in the conversion of BASIC programs to C. It will not, however, enable a BASIC programmer to produce C programs without any knowledge of the C language. The BASIC\_C Library manual is written with the C novice in mind and is one of the better introductions to C available, particularly for those familiar with the details of BASIC.

Version 1.0 of BASIC\_C has about 75 functions in the library. Table 1 lists the corresponding BASIC and BASIC\_C functions. No math functions are included. The





# LET'S TALK EXPERT-TO-EXPERT

**PC TECH JOURNAL, the magazine written for sophisticated IBM PC users...talks with you expert to expert!**

Do you require a magazine that provides you with the insight and knowledge to act as your silent partner when designing new systems? Have you needed to consult with authorities in telecommunications to resolve a nagging problem? Wouldn't a second opinion about connecting your PC to a main-frame be helpful? With your subscription to PC TECH JOURNAL, you're harnessing experts in your field...experts who will talk to you in the language you understand, about the concerns you have...**EXPERT TO EXPERT!**

PC TECH JOURNAL is the technologically sophisticated magazine written for experts in the field of personal computing like yourself...discussing the concerns experts have...developing elegant programming methodologies only experts can understand...covering the whole field of IBM PC's with thought-provoking articles on communications, distributed processing, office automation, networking and programming.

Subscribe today and save up to 27% off the full subscription price, and have PC TECH JOURNAL delivered to your home or office every month! From One Expert to Another: *Subscribe Today!*

**TECH<sup>PC</sup> JOURNAL**

P.O. Box 2966, Boulder, Colorado 80322

PT 4Z015

**YES,** I want to communicate with other experts and professionals about IBM PC's and compatible machines! Please enter my subscription to PC TECH JOURNAL for:

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> 9 issues<br>for \$19.97—<br>SAVE 11%! | <input type="checkbox"/> 12 issues<br>for \$24.97—<br>SAVE 17%! | <input type="checkbox"/> 24 issues<br>for \$43.97—<br>SAVE 27%! |
|--|---|---|

Mr./Mrs./Ms. \_\_\_\_\_  
please print name in full

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Savings based on full one-year (12 issues) subscription price of \$29.97.

**Check one:** ☐ Payment enclosed. ☐ Bill me later.

Charge my: ☐ American Express ☐ Visa ☐ MasterCard

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Add \$12 a year in Canada and all other foreign countries. Please allow 30 to 60 days for delivery of first issue.



# BASIC TO C

reason for this, according to a brochure issued by C Source, is that math functions belong in a standard library, "and only the Lattice/Microsoft C compiler does not have them." Version 2.12 of the Lattice compiler, which includes math functions, is now available.

For writing programs that do not require trig, log, exponential, or random functions, however, the BASIC\_C Library is a welcome addition to the C environment for both the experienced C programmer and the novice. A loan payment calculation program serves as an example of a BASIC program (listing 1) translated to C (listing 2) using the BASIC\_C Library. The example illustrates the conversion of a GOSUB into externally defined functions. It does not use any arrays, pointers, or the COLOR function.

Generally speaking, documentation for BASIC\_C helps a BASIC programmer who has studied C syntax translate programs into C. De-

bugging these programs, however, is another matter. A programmer accustomed to BASIC will find that a new set of debugging skills is needed in the C environment. Also, C programs that are written in the

**U** *Using C to mimic BASIC does not take advantage of the full powers of C.*

style of the examples, virtual line-by-line translations from BASIC, are valuable as exercises in making the change from BASIC, but generally are not examples of good programming practices in C. For this reason, the gain in efficiency and speed over compiled BASIC may not be as great as anticipated. The good performance of C is due in part to its concise syntax. Using C to mimic BASIC does not take advantage of the full powers of C.

Although BASIC\_C does an admirable job of getting a BASIC programmer started in making the transition to C, the product would be greatly improved if the documentation gave the user a better picture of what the final destination is. One way of doing this would be to provide more advanced examples that illustrate how the library can be used to write professional C programs, explaining the steps taken beyond the BASIC format of the simpler examples.

One relatively minor bug with the COLOR function could be a problem. Unlike the other functions in BASIC\_C, COLOR does not behave the way its BASIC counterpart does. In IBM BASIC the COLOR statement can be used to set the color attributes of foreground, background, and border, clear the screen with CLS, and exit to DOS; the color attributes will remain in effect for the DOS environment. With the BASIC\_C COLOR func-

## SPF/PC™

ACTUALLY, there is no comparison. SPF/PC is the best full-screen editor available for the IBM Personal Computer.

It looks and works like IBM's large system SPF editor.

- SPF/PC can use up to 786K of memory as workspace.
- Word processing commands.
- 4-way scrolling.
- Split screen support.
- On-line help facility.
- Can edit up to 240 character records.
- Monochrome or color supported.
- Instantaneous screen display.
- Block Move/Copy/Repeat/Delete/Overlay/Shift/Exclude
- Automatic line numbering supported.
- 40 user-definable Program Function Keys.
- Direct interface to DOS commands for PC DOS 2.0 users.
- Browse sub-system.
- Move/Copy sub-system copies any file format.
- Utilities include: Rename/Delete/Print/Directory list.

AND MUCH MORE . . .

UPLOAD/DOWNLOAD sub-system available to SPF/PC users for \$50.00.

**\$149.95**

SPF/PC requires 128K, PC DOS, and 1 disk drive.

## THE ODD-COUPLE™

Allows the APPLE and IBM/PC to communicate with each other.

- Connect APPLE to PC, APPLE to APPLE, and PC to PC.
- Transfer any file in either direction.
- CHAT mode allows direct communications through the keyboard.
- An Equipment Profile allows description of your operating environment.
- Communicate Direct or through a Modem at speeds up to 9600 baud (bps).
- Written entirely in machine language for speed and efficiency.

### REQUIREMENTS:

APPLE — 48K, 1 disk drive, Serial Interface  
IBM — 64K, 1 disk drive, Serial Interface

**\$79.95**

For orders and dealer information write or call Rogue River Software, 2822 Tahitian Ave., Medford, OR 97504, (503) 779-3002. Mastercard/Visa, Check, or P.O. accepted. Add \$5.00 for shipping. Canada \$10.00. Foreign \$15.00.

IBM is a registered trademark of International Business Machines, Inc. APPLE is a registered trademark of Apple Computer Inc.



# How Can You Avoid Getting Trapped Under An Ancient Word Processor?



**Buy Word Perfect!**

Once upon a time, word processors were monstrous things. Dot commands, page orientation, and separate editing, formatting and printing programs turned them into lumbering beasts. Only a well-educated programmer would dare don his armor and tackle such a beast — not a pleasant task for a modern secretary, executive, or writer.

Then came WordPerfect and the beast was slain.

WordPerfect was designed to work for you not against you. WordPerfect has no command language to complicate your writing. Pressing a single key is all it takes to

**bold**, underline or center.

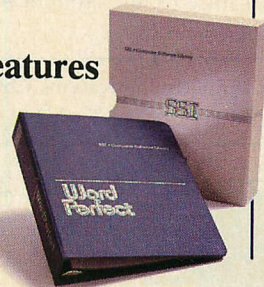
When writing, you don't want to worry about page formatting, making room for headers or footers, or

whether you are in "edit" or "create" mode. Your word processor should do it automatically and WordPerfect does. WordPerfect lets you think in terms of ideas, not pages. It is simple enough that you quickly forget about the mechanics and your writing flows easily.

So if you don't want to be caught under a word processing monster, try WordPerfect. We're certain it will improve the quality of your writing.

## UWord Perfect

**You'll love it —  
not only for the features  
we've built in, but  
also for the  
antiquities  
we've  
left out.**



SATELLITE SOFTWARE INTERNATIONAL

288 WEST CENTER STREET, OREM, UTAH 84057 (801) 224-4000 TELEX 820-618

CIRCLE NO. 236 ON READER SERVICE CARD

# SSI



# BASIC TO C

tion, on the other hand, a print statement has to be issued for the color attributes to appear, and it is not possible to set the border color and keep it after exiting to DOS. These are not very serious problems, but they should either be fixed or be properly documented.

For experienced C programmers, the BASIC\_C Library has

some handy functions that are rarely found for the IBM PC. Among them are BLOAD(), BSAVE(), SET\_TIME(), GET\_TIME(), SWAP(), POINT(), and BEEP. Many of these functions, for example, are not included in the Greenleaf Functions, by Greenleaf Software, Inc., which claims to be the most inclusive C library.

## BASTOC

JMI Software Consultants have ported to the IBM PC a product that produces C source code from BASIC ASCII files (minus interpreter-oriented functions and those that interface to MS-DOS). Generic MS-BASIC falls short of PC BASIC, but many programs written in it can run under the PC's BASIC interpreter. The main intended PC-related use of the translator is to help move programs first written in BASIC in the CP/M environment into C on the PC.

Three versions are available for the IBM PC: the Computer Innovations version 1.33D, the Lattice 2.0, and Quantum 1.1 C compilers. The version evaluated here is BASTOC 1.4 for the Lattice 2.0 compiler. JMI offers a source license for BASTOC at a price of \$15,000, and maintenance is set at \$3,000 per year.

The BASTOC system has two parts: the translator program and its accompanying library. There are three main modes or options available in using BASTOC. It can produce a monolithic program with all code imbedded in one main segment, it can produce a structured program in which the GOSUBs are decomposed into a number of functions, or it can convert the BASIC program into a C function. The user also may customize the BASTOC system in various ways.

BASTOC comes on three double-sided floppy diskettes and includes a rather short, spiral-bound booklet for documentation. The files provided on the diskettes include the translator program and both translator and link libraries for all four of the Lattice 2.0 memory models. Also included is the object module for the translator, several header files, and the C source for syntax and parameter tables, so that BASTOC can be modified to suit different purposes. The translator is written in and produces machine-independent C that adheres to the standard specified in *The C Pro-*

THE MOST EXTENSIVE  
LIBRARIES ANYWHERE  
for the IBM PC, XT

## THE GREENLEAF FUNCTIONS

Total Access to the PC

PROFESSIONAL PROGRAMMER'S TOOLS, With Comprehensive Manual, Full Source, Examples, Demos, & Newsletter.

Supports All Major Compilers, All Memory Models, DOS 1.1, 2.0, 2.1

IBM • Honeywell • Control Data • GE • Lotus . . .  
Hospitals • Universities • Government • Aerospace . . .  
Why not for your application?

Save Months of Painstaking Research

**GENERAL LIBRARY** – What You Would Write If You Had The Time  
• 200 functions • DOS 2.0 • Video • String • Printer • Async • Color • Time & Date  
• Function Keys • Diagnostic • More

#L2 for Lattice or Microsoft, or #C2 for CI C86 . . . . . \$175<sup>00</sup>  
#D1 for DeSmet C . . . . . \$ 99<sup>00</sup>

**ASYNCCOMM LIBRARY** – Interrupt Driven Communications Capability  
• Polled Mode • Interrupt Mode • Ring Buffered • Modem Control • CRC  
• XMODEM Protocol Pieces • More

#L3 for Lattice or Microsoft, or #C3 for CI C86 . . . . . \$160<sup>00</sup>  
#D3 for DeSmet C . . . . . \$ 85<sup>00</sup>

#CC1 Computer Innovations C86 Compiler V2.1 . . . . . \$349<sup>00</sup>  
#CC2 Lattice C Compiler V2.1 . . . . . \$395<sup>00</sup>



(214) 446-8641

• Order Direct or Ask Your Dealer  
• MasterCard or VISA Accepted

• Add \$7.00 Shipping Per Item  
• Specify Compiler and  
Our Part Number

**GREENLEAF SOFTWARE, INC.**

2101 HICKORY DRIVE • CARROLLTON, TEXAS 75006



AND NOW, BESIDE COMPAQ, SPERRY, COLUMBIA, CORONA, AND ZENITH, TOO.

# Beside Your IBM PC Or XT, The Best Box You Can Buy.

## The Bernoulli Box™: The Superior Storage Solution.

For owners and users of the IBM PC, XT, COMPAQ, Sperry, Columbia, Corona, and Zenith micros, where to put and secure the substantial amounts of data they are processing can get to be quite a problem.

Well, IOMEGA has quite a solution. We call it The Bernoulli Box.

### Hard Disk Performance And Reliability. Flexible Disk Economy And Convenience.

The Bernoulli Box is a mass storage system that uses 10-megabyte removable cartridges to deliver incredible versatility and virtually unlimited storage capacity. Powerful primary storage. Quick and efficient backup. With the performance, data integrity, mechanical reliability, and low cost per megabyte equal to Winchester hard disks.



### A Handful of Cartridges Or A Desktop Full Of Hardware. You Decide.

The bottom-line beauty of The Bernoulli



Box is that when you need more mass storage, you buy more cartridges—not more iron. So you save space, time, money, and get higher performance and a more

reliable storage solution to boot.

### Check Out The Bernoulli Box Today.

Computer dealers know a good idea when it comes around. Many are currently stocking The Bernoulli Box in both single- and double-drive models.

For the dealer nearest you, contact IOMEGA at (801) 776-7330.



IOMEGA Corporation  
1821 West 4000 South  
Roy, Utah 84067

CIRCLE NO. 102 ON READER SERVICE CARD



**Table 2: BASIC Language Features Supported by BASTOC**

## STATEMENTS

CALL 'ident [(argument) {, argument}]  
 CHAIN file name  
 CLEAR [, string space [, stack space]]  
 CLOSE [(#) number {, (#) number}]  
 CLS  
 DATA datum {, datum}  
 DEF FNx (id {, id}) = expression  
 DEF FNx (id {, id})  
 DEFDBL letters {, letters}  
 DEFINT letters {, letters}  
 DEFSNG letters {, letters}  
 DEFSTR letters {, letters}  
 DEFUSR[n] = number  
 DIM array-decl {, array-decl}  
 END  
 ERASE array name {, array name}  
 ERROR number  
 FEND  
 FIELD [(#) number, fwidth AS svar {, fwidth AS svar}]  
 FILES [pattern]  
 FOR v = initial-value TO limit [STEP increment]  
 GET [(#) number, recno]  
 GOSUB line number  
 GOTO line number  
 If expression THEN statements [ELSE statements]  
 INPUT [string-constant;] variable {, variable}  
 INPUT # number, variable {, variable}  
 INTEGER identifier-list  
 KILL file name  
 [LET] variable = expression  
 LINE INPUT [string-constant;] variable {, variable}  
 LINE INPUT # number, variable {, variable}  
 LPRINT [USING format]...  
 LSET name = string  
 MID\$(old string, position [, length]) = new string  
 NAME old file AS new file  
 NEXT [variable {, variable}]  
 NEW  
 ON ERROR GOTO line number

ON expression GOSUB line number {, line number}  
 ON expression GOTO line number {, line number}  
 OPEN "I", [(#) number, string]  
 OPEN "O", [(#) number, string]  
 OPEN "R", [(#) number, string]  
 OPTION BASE  
 OUT port number, data-byte  
 POKE addr, value  
 PRINT [(#) number,] [USING format,] expr {p expr} [p]  
 PRINT@ number, ...  
 PRINT@ (number, number), ...  
 PUT [(#) number, recno]  
 RANDOMIZE [expression]  
 READ variable {, variable}  
 REM ...  
 RESTORE  
 RESUME [line number] and RESUME NEXT  
 RETURN  
 RSET name = string  
 RUN  
 STOP  
 SWAP variable1, variable2  
 TROFF  
 TRON  
 WAIT port number, mask [, pattern]  
 WEND  
 WHILE expression  
 WIDTH [filenum,] size and WIDTH device name, size  
 WRITE [(#) filenum,] expr {, expr}

## OPERATORS

+ add  
 \* multiply  
 ^ exponentiate  
 = equals  
 <= less than or equal  
 < less than  
 NOT bitwise negation  
 OR bitwise disjunction  
 IMP bitwise implication

*gramming Language* (Kernighan and Ritchie, 1978).

The BASIC statements and functions supported in the current release of BASTOC are listed in table 2. Particularly important for those wanting to translate IBM PC BASIC programs is the absence of the SCREEN, COLOR, LOCATE, KEY, COM, PRINT USING, and BEEP statements. The translator does recognize the PRINT@ construction for printing at a specified screen location, so it is possible either to edit existing BASIC programs that use the LOCATE statement or to write new programs targeted at the translator.

The translator program itself offers a total of seven different options for its output:

1. To make blanks significant as separators between key words.
2. To insert the BASIC source as comments in the C code
3. To translate the BASIC code into one or more functions
4. To produce one monolithic C function instead of mapping each GOSUB into a separate function
5. To use a specified file name as the output file
6. To convert BASIC integers to C variables of the "short" data type
7. To issue statement trace directives (statements only).

The best features of the BASTOC translator are its speed, its variety of options, and its capability to produce a C source file no matter what, with the BASIC lines it was unable to translate inserted in the code as

comments. Especially impressive is its speed. Unless there are a large number of error messages, the translator will generally finish a given program considerably sooner than would Lattice 2.0. The error messages specify the problem and print the troublesome BASIC line with a dotted line pointing, if necessary, to the problem location.

The resultant C code is well formatted, but unfortunately the label and function names are unfamiliar and not easy to read, which severely limits the usefulness of the generated code. An example of a BASIC program that translated as is into C, and that compiled, linked, and executed successfully, is provided in listing 3 (BASIC) and listing 4 (C).



MOD integer remainder  
 - subtract  
 / divide  
 \ integer divide  
 <> not equal  
 >= greater than or equal  
 > greater than  
 AND bitwise conjunction  
 XOR bitwise exclusive OR  
 EQV bitwise equivalence

## FUNCTIONS

ABS(X#)—absolute value  
 ASC(S\$)—ASCII code for first character of S\$  
 ATN(X#)—arc tangent  
 CDBL(expression)—converts expression to double precision  
 CHR\$(N#)—character with ASCII code N#  
 CINT(expression)—converts expression to integer  
 COS(X#)—cosine (of an angle in radians)  
 CSNG(expression)—converts expression to single precision  
 CVD(F\$)—convert F\$ to double precision  
 CVI(F\$)—convert F\$ to integer  
 CVS(F\$)—convert F\$ to single precision  
 DATE\$—current date  
 EOF(N#)—indicate end of file condition  
 ERL—line number where last error occurred  
 ERR—error code of last error that occurred  
 EXP(X#)—exponential function  
 FIX(X#)—integer part of X#  
 FRE—available free storage  
 HEX\$(N#)—convert N# to hexadecimal string  
 INKEY\$—read a character from the standard input  
 INP(N#)—input a data byte from port N#  
 INPUT\$(N%, [#] filenum)—input N% bytes from a file or keyboard  
 INSTR([N%,] S\$, P\$)—position of P\$ in S\$  
 INT(X#)—largest integer less than X#

LEFT\$(S\$, N#)—leftmost N# characters of S\$  
 LEN(S\$)—number of characters in S\$  
 LOC(filenum)—returns record number of last processed record in file  
 LOF(N#)—length of file in records  
 LOG(X#)—natural logarithm  
 LPOS(N#)—position of line printer print head  
 MID\$(S\$, I%, L%)—L% characters of S\$ starting with I%  
 MKD\$(N#)—convert double precision to string  
 MKI\$(N#)—convert integer to string  
 MKS\$(N#)—convert single precision to string  
 OCT\$(N#)—convert N# to octal string  
 PEEK(N#)—reads byte in memory location N#  
 POS—position of cursor  
 RIGHT\$(S\$, N#)—rightmost %N characters of S\$  
 RND()—random number  
 SGN(X#)—algebraic sign of X#  
 SIN(X#)—sine (of an angle in radians)  
 SPACES(N#)—string of N# spaces  
 SPC(N#)—print N# spaces in a PRINT or LPRINT statement  
 SQR(X#)—square root  
 STR\$(N#)—returns string expression of N#  
 STRING\$(N%, M#)—string of N% ASCII M# characters  
 STRING\$(N%, S\$)—string of N% S\$ characters  
 TAB(N#)—tabs to column N# in a PRINT or LPRINT statement  
 TAN(X#)—tangent (of an angle in radians)  
 TIME\$—current time  
 USR[n] [argument]—call a user function  
 VAL(S\$)—returns numeric value of S\$  
 VARPTR(variable)—address of variable in memory

## COMPILER DIRECTIVES

%INCLUDE name—include named source file  
 %LIST, %NOLIST—allowed for compatibility with CBASIC, but ignored

The BASTOC translator has a number of limitations and idiosyncracies—some of which are documented but many of which are not. An important documented limitation is that the translator will not handle nested subroutines or multiple entry points within a given subroutine. In either case, an error message is sent to the screen during translation and imbedded in the C source as a comment.

Another undocumented limitation is that BASTOC does not recognize various syntactic nuances that BASIC programmers have devised for optimizing their code, such as using NEXT instead of, say, NEXT I. Neither does BASTOC recognize the use of the % symbol for declaring integer variable values. An ap-

parent bug prevents BASTOC from handling the READ . . . DATA construction properly. Programs

**The best features of the BASTOC translator are its speed, its variety of options, and its ability to produce a C source file no matter what the difficulties are.**

that used this construction translated, compiled, and linked with no error messages. At run time, however, the executing program stopped to deliver a message that it was not given sufficient data, even though

all of the BASIC data statements were present in corresponding C statements in the source file.

Generally, BASTOC should not be expected to translate many programs flawlessly so that they will compile and execute, without some meticulous editing of the BASIC or C source code. Of more than 20 programs scrupulously written in Microsoft BASIC dialect, only five produced executable C files that performed as the BASIC programs did. Two of the five were examples provided by JMI. Once, inexplicably, BASTOC failed to include a required C routine; this omission made the resulting program function improperly, even though no error messages were given during translating, compiling, or linking.



# the 1dir

## DIRECTORY COMMAND SYSTEM for the IBM PC & XT

*Which would you prefer?*

A>

THIS  
←  
or  
THIS  
→

Drive A	Name	Ext	Size
	BOURBAKI	INC	VOLUME
	DATABASE		>SUB-DIR
	EDITOR		>SUB-DIR
	FINANCE		>SUB-DIR
	TELECOMM		>SUB-DIR
	1DIR	COM	9659
	AUTOEXEC	BAT	23
	CHKDSK	COM	1720
	COMMAND	COM	17664
	DISKCOPY	COM	2000
	DOS	FWK	162
	EDLIN	COM	2392
	FORMAT	COM	3816
	FUNKEY	COM	3633
	MODE	COM	2509

Run

— Designed with the "New User" in mind

— A must for Hard Disk systems

— Compatible w/DOS 1.10 and 2.00

**1dir** replaces the DOS prompt with an interactive command system that eliminates the need to type commands and/or filenames to the command line. Files are accessed and programs are executed by positioning **1dir**'s scrolling FILE and COMMAND CURSORS, and pressing <ENTER>. Controlled by the arrow keys, the CURSORS are easy to use "pointers."

Suggested Retail  
**\$95.00**

by Bourbaki Inc.



P.O. Box 2867, Boise, ID 83701, (208) 342-5849

CIRCLE NO. 108 ON READER SERVICE CARD

## YOUR CODE MAY BE WASTING ITS TIME! THE PROFILER™ CAN HELP . . .

- Statistical Execution Profiler
- Works with any language
- Completely configurable
- Up to 16 partitions in RAM/ROM
- Time critical code optimization
- Abnormal code behavior tracking
- Graphic presentation of results
- Easy to use menu interface

**THE PROFILER** is a software package which gives you, the programmer, a powerful tool for locating time consuming functions in your code and allows you to performance tune your program. With the **THE PROFILER** you can determine where to optimize your code for maximum benefit, then measure the results of your efforts.

Using **THE PROFILER**, you can answer questions like:

- Where is my program spending its time?
- Why is my program so slow? What is it doing?
- Is my program I/O bound? CPU bound? Are data buffers large enough?
- How much improvement did my changes make?

**THE PROFILER** is completely software based and consists of a system resident driver and a monitor program. The memory partitions can range from 1 byte to 1 megabyte in size and can be anywhere in the address space.

### NO ADDITIONAL HARDWARE IS REQUIRED!

Requires an IBM PC or compatible system with a minimum 64k and one drive.

**THE PROFILER** is available for \$175.00 from DWB Associates or ask your software dealer. To order or for more information, call or write DWB Associates. VISA/MC accepted. Dealers welcome.

IBM is a trademark of IBM Corp. MSDOS is a trademark of Microsoft Corp.  
**THE PROFILER** is a trademark of DWB Associates.

CIRCLE NO. 216 ON READER SERVICE CARD



P.O. Box 5777  
Beaverton, Oregon 97006  
(503) 629-9645

## BASIC TO C

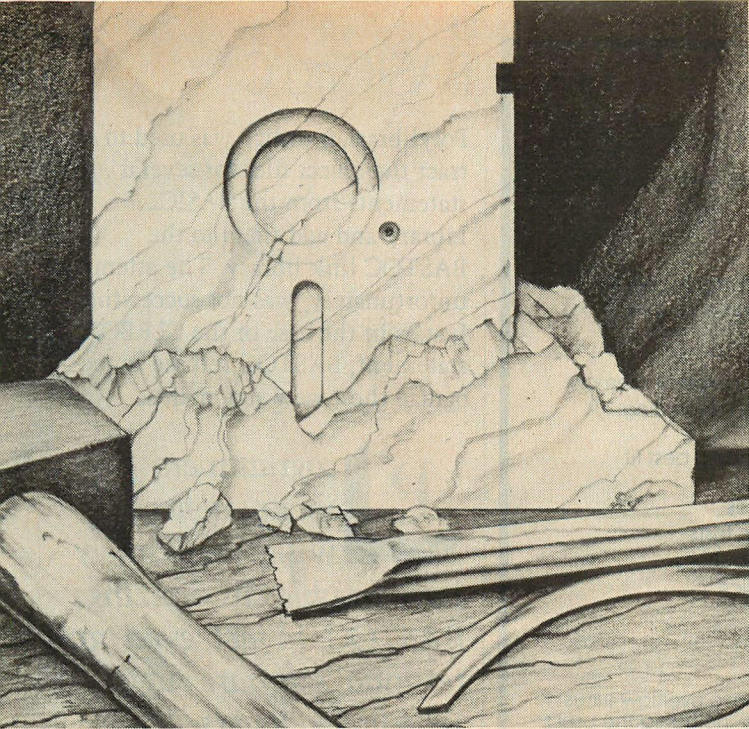
In spite of these limitations, BASTOC can be a valuable tool for an experienced C programmer. For large programs, probably the only workable procedure is to choose the option that breaks the BASIC code into a number of separate C functions. In this case, the programmer will have a number of usable modules right away. The faulty modules can then be isolated, edited in the BASIC or C source, or rewritten using BASIC\_C or one of the other available C libraries. Finally, a main segment can be added that calls all the separate function modules. There should be few BASIC programs that cannot be moved to C in this way. The user must decide whether this method is preferable to rewriting a program.

The documentation for the BASTOC package gives examples of how to add statements, functions, and operators to the system. Several steps are involved. First, the new function must be written in C and compiled. An entry must be added to the appropriate key-word array in the provided file ATLBLS1.C and compiled. The BASTOC manual fails to mention that if any new declarations of parameters are needed, these have to be added to the header file AT.H. Otherwise, the file will not compile.

A librarian utility (see "Checking Out the Librarians," Kuryan Thomas, p. 80 in this issue) is needed to add the object file for the newly created function to the BASTOC link library. Finally, the new modules must be linked into a newly created translator program. In a test this customizing capability was able to add the MAX function to BASTOC, but the translator refused to recognize the CLRBOX statement, even though all the steps were carried out.

The possibility that existing object files emulating BASIC functions, such as those in the BASIC\_C Library, can be added to BASTOC is a tantalizing one. To try it, the





*"In the art  
of programming  
the difference between  
greatness and mediocrity  
is often the quality of  
the artist's tools."*

#### **POLYOVERLAY**

**Make Maximum Use of Memory with Overlay Code.** Creates optimal memory overlay structures, in terms of utilizing a minimum of total physical memory, while it builds a batch file to automatically drive an overlay linker, for creating efficiently overlaid executable code. Creates optimum overlay structures for any modular language including C, FORTRAN, Pascal, Ada and even BASIC. Essential for porting mainframe code too large to fit into personal computer's memory all at one time. Requires MS-DOS 2.0, and Microsoft's Linker Version 2.4 Shipped with Users Manual .....**\$99**

#### **POLYTRON C LIBRARY 1**

**A Library of High-Performance Functions for Lattice C Compiler Users.** Over 50 significant routines more useful than common library functions. The library includes UNIX-like utility functions, file management functions, more efficient and flexible I/O routines, and executive functions. This is a powerful, professional-quality C library that is easy to use and designed to increase your productivity. Assembly and C source code included. Requires Lattice C Compiler Includes Users Manual. ....**\$99**

#### **POLYLIBRARIAN**

**The Object Module Library Manager for MS-DOS™.** PolyLibrarian lets you create a single library from related Objects Modules. The IBM PC Linker will then select only the modules necessary to produce an executable file. PolyLibrarian can: Create, organize, reconstruct, dissect, and compress libraries of object code modules. Add, delete and replace an object module. Extract a module from a library to create an OBJ file. Change public and external names. Modules are time-stamped within the library. Supports full path names. Supports Microsoft's original and latest Linker (Version 2.4). Includes installation program to customize options to your specific needs. Features three Modes of Operation (Interactive, Command File, Command Line) that can be freely intermixed. Surpasses performance of other primitive librarians. Features a highly functional user interface that uses simple meaningful key words. Requires 128K RAM, MS-DOS (PC-DOS) 1.1 or 2.0. Compatible with any compiler or assembler that uses the MS-DOS (PC-DOS) Linker. Shipped with comprehensive Users Manual including step-by-step tutorial for .....**\$99**

#### **POLYLIBRARIAN II**

**Extends PolyLibrarian's power to Intel™ and Digital Research™ Format Libraries.** PolyLibrarian II is an enhanced version of PolyLibrarian. In addition to all the features and functions listed above for PolyLibrarian, this version adds a new dimension of productivity for programmers using Intel and Digital Research Language Products. Compatible with any Intel Format Library and any Microsoft Format Library. Compatible with Intel's Link 86 under MS-DOS. Compatible with Digital Research Linker under MS-DOS .....**\$149**

#### **POLYMAKE**

**The Intelligent Program Builder & Maintenance Tool for MS-DOS.** PolyMake frees you from the need to remember which files depend on others and which files have been modified. PolyMake will: Remember the exact sequence of operations necessary to make a new version of a program. This will significantly reduce development time, prevent bugs & manage large software projects. Automatically invoke your compiler, assembler, linker, librarian, or do whatever is necessary to bring all dependent files up to date. Compare the date and time of all relevant files and use internal rules to rebuild a program or complete software system. Rules can be modified and expanded. Extensive debug capabilities help construct efficient make files. Includes features superior to UNIX Make. Fully automatic operation under MS-DOS 2.0. Full path name capabilities under MS-DOS 2.0. Requires 128K. Shipped with a comprehensive Users Manual .....**\$99**

#### **POLYFORTRAN TOOLS 1**

**Four Powerful Utilities in One Package.** For developing or enhancing software or porting mainframe software to personal computers these easy-to-use tools will become indispensable for the professional FORTRAN programmer. Includes: 1. **FORTTRAN-XREF** for developing comprehensive cross-reference maps of FORTRAN source code. Mainframe users expect this kind of utility. Now personal computer users have X-REF power. 2. **FORTTRAN-EXTRACT** extracts the MAIN routine as well as all SUBROUTINES, FUNCTIONS and BLOCKDATAS from FORTRAN source code. It is unsurpassed for breaking-up large codes into manageable modules that can be individually modified, compiled, added to libraries and finally linked into a single executable code. 3. **FORTTRAN-CLEANUP** performs three critical functions to improve FORTRAN source code readability: A. Renumbers FORTRAN source code statements within each routine to begin at a user specified starting number; B. Adds spaces around delimiters and key words; C. Performs indentation for DO loops, IF...Then and similar structures. If you are becoming weary of cleaning up "sloppy" code then you need FORTRAN-CLEANUP. 4. **FORTTRAN-SCREEN** lets you show off your software. This is a complete set of FORTRAN callable screen attribute and cursor position control functions for creating user friendly, interactive menus and displays. Requires MS-DOS 2.0, 256K, One Disk Drive, Compatible w/hard disk. Shipped with Users Manual .....**\$179**

### *Praise From Professionals*

"PolyLibrarian is a powerful tool for serious hobbyists and professional programmers. It is a thing of beauty; a work of art. The documentation is excellent, the large selection of commands are intuitive to learn and easy to use, and the program itself provides a service of inestimable value. It is refreshing to see a tool of this caliber available for serious programmers. The design of this program shows foresight and ingenuity. It sets the human engineering standard for programming utilities. If all of a programmer's tools were so simple to work with, better programs could be developed in less time and with fewer headaches. Bravo, Polytron! I look forward to your next product."

*Dan Rollins,  
Programmer and Author writing in PC Age*

"PolyLibrarian is an extensive, friendly utility . . . an excellent tool for serious programmers. It combines professional quality with a flexible user interface."

*Greg Estes  
Editor, Programmers Journal*

"I am thoroughly pleased [PolyLibrarian] is definitely one of the best products of its type that I have ever used on any system."

*An Unsolicited Comment from  
Steve Kauffman  
Consulting Engineer*

To Order or Request Literature Call  
**1-800-547-4000**

Ask For Dept. 310

VISA & MasterCard Accepted  
Or Send Checks, P.O.'s To:

**Polytron Corporation DS-310-F1**  
P.O. Box 787, Hillsboro, OR 97123

Add \$1.25 Shipping Charge For Each  
Product Ordered.

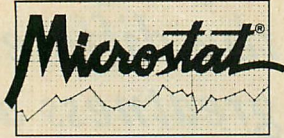
CIRCLE NO. 268 ON READER SERVICE CARD

M

**POLYTRON**



## New Release 4.1



We've continually improved Microstat since it was introduced in 1978, and the latest release includes many new features you've wanted.

Interactive and Batch Processing  
Expanded Data Management  
Subsystem with New Data  
Transforms  
Reading data files created by other  
programs  
3 types of Analysis of Variance  
Time Series  
Crosstabs and Chi-Square  
Factorials, Permutations, and  
Combinations  
Hypothesis Tests

Data sets that can exceed memory  
Multiple Regression (including  
Stepwise)  
Scatterplots (including best fit  
regression)  
Correlation Analysis  
12 Nonparametric tests  
8 Probability Distributions  
Descriptive Statistics  
Easy Installation

Microstat's algorithms have been designed to prevent numeric overflow errors and yield unsurpassed accuracy. Microstat's price is \$375.00 including the user's manual and is available for the Z80, 8086, 8088 CPU's and CP/M80, CP/M86, MS-DOS, and PC-DOS. To order, call or write.



6413 N. College Ave. • Indianapolis, IN 46220  
(317) 255-6476



Trademarks: Microstat (Ecosoft), CP/M (Digital Research), MS-DOS (Microsoft), PC-DOS (IBM), Z80 (Zilog), 8086, 8088 (Intel).

CIRCLE NO. 109 ON READER SERVICE CARD

## BASIC TO C

Polylibrarian utility was used to extract the object files for several statements from the BASIC\_C Library and add them to the BASTOC link library. The attempt, unfortunately, was not successful. Just as in the case of the CLRBOX statement, BASTOC refused to recognize these new statements.

**P**rogrammers inexperienced with C will likely have trouble customizing BASTOC. In fact, even professional software engineers who are well-versed in C may discover that their efforts are frustrated.

Programmers inexperienced with C will likely have trouble customizing BASTOC. In fact, even professional software engineers who are well-versed in C may find their efforts frustrated.

### BASIC TO C SYNERGY

Although the attempt to add functions from the BASIC\_C Library to BASTOC did not succeed, these two products can complement one another in a number of ways. This is an area now being explored.

As mentioned earlier, if a modular approach is used for moving large programs from BASIC into C by using the BASTOC option that maps BASIC modules into separate C functions, then BASIC\_C can be used to recode those modules that don't translate successfully. On the other hand, the BASTOC libraries can also be used to complement the statements supported in BASIC\_C. This would be done by calling functions in the BASTOC library as well as BASIC\_C in C programs or functions that the user writes.

The unfamiliar function calls and the lack of documentation about them prevents this from be-



**Keep a complete computer accessories store in your desk drawer.**

You can choose from over 2400 products, many unavailable from retail stores.

■ **Faster service.** All 9 Inmac branches are fully stocked, so your order can be filled the day we receive it.

■ **45-day risk free trial.** Full refund if not completely satisfied.

■ **Guaranteed quality.** Most guaranteed for one year, some guaranteed for life.

■ **One stop shopping.** Paper, connectors, cables, furniture, media, modems and more.

■ **Easy ordering.** Mail, phone or TWX. Verbal P.O.s welcome.

**1-800-547-5444.\***

\*In CA, call 1-800-547-5447.

694102

**inmac**

Please send me a free copy of Inmac's Computer Supplies Catalog.

Inmac Catalog Dept.  
2465 Augustine Drive  
Santa Clara, CA 95051

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_  
STATE \_\_\_\_\_ ZIP \_\_\_\_\_ PHONE \_\_\_\_\_

CIRCLE NO. 138 ON READER SERVICE CARD



# Get Your Hands On Our Hands-On Analysis

## Introducing **Data Decisions**™ MICROCOMPUTERS

An **ALL-NEW** information service  
for the corporate micro buyer

that features

### Hands-On-Testing of Micro Software



## by Experts in **Data Decisions**™ **OWN LABS**

Ask for a trial review of MICROCOMPUTERS and let Data Decisions do your software testing for you. You'll get the results of hundreds of hands-on tests **done under consistent, controlled conditions** by our team of micro experts . . . You'll find out how competing packages measure up against each other and what you can expect when you bring them in-house.

And that's just the beginning! Along with everything you need to know about spreadsheets . . . graphics . . . word processors . . . and other software products—you also get the latest word on business microcomputer systems . . . expansion/extension cards . . . communications products . . . peripherals—all the products and technologies you need to know about to grow.

MICROCOMPUTERS comes to you in three monthly updated loose-leaf volumes that are **consistently formatted** for easy product comparisons . . . and for finding the facts you need FAST.

Whether you're looking at LANs, PC compatibles, printers for micros, or the new integrated software packages, Data Decisions MICROCOMPUTERS supports you every step of the way. We have:

- **Hands-on evaluations** of software products by micro experts.
- **Rating charts** that let you compare how competing packages measure up in actual use.
- **In-depth analyses** that highlight strengths and limitations of mainstream products.
- All the **pricing** and **spec's** you need for feasibility studies and budgets.
- **Technology reports** that fill you in on issues and trends.

CIRCLE NO. 126 ON READER SERVICE CARD



**We do the hands-on testing for you**

☐ **C5** Yes, please send me my TRIAL REVIEW of MICROCOMPUTERS. I understand that I'm under no obligation to purchase anything and that I may keep the free report even if I don't become a subscriber.

☐ **Y4** Although your offer is completely risk-free, I'm still not sure. Please provide more information.

- **Unlimited free telephone consulting** by micro experts whose only job is to answer your questions.
- **Broadbased surveys . . . monthly newsletters . . . complete vendor directory . . . MORE.**

A 1-year subscription to Data Decisions MICROCOMPUTERS costs only \$700. You get all this information and analysis for less than it would cost you to hire a consultant to test just one product!

### *But don't take our word for it . . .* **SEE FOR YOURSELF!**

Examine MICROCOMPUTERS at your leisure in your own office before you buy. Just fill in the coupon and mail it today. You'll receive a no-purchase-obligation TRIAL REVIEW.

**FREE BONUS REPORT:** And as an added bonus . . . just for taking a trial review of MICROCOMPUTERS, we'll also send you a free copy of

### **Business Communication Networks— Putting It All Together**

This special information-packed technology report shows you how to build a user network—from policy planning . . . to the selection and integration of products . . . to network management and control. It regularly sells for \$39.00. . . . But it's yours to keep **ABSOLUTELY FREE**—Just for agreeing to review MICROCOMPUTERS . . . So fill in the coupon TODAY!

**Data Decisions**™

20 Brace Road/Cherry Hill, NJ 08034/609-429-7100

**Data Decisions**™

20 Brace Road/Cherry Hill, NJ 08034/609-429-7100

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone ( \_\_\_\_\_ ) \_\_\_\_\_  
Area Code



# BASIC TO C

ing as straightforward as it should be, but with some study of the BASTOC output code it should not be too difficult. A header file that mapped the obscure names of the BASTOC functions into more familiar ones would make the process easier. Fortunately, many of the functions that would be useful here, such as the trig, log, exponential,

and random math functions, already have familiar names.

Another way that BASTOC can help write programs with BASIC\_C is by providing examples of various strategies for translating a given program. Although the program or function may not have been automatically translated without error, BASTOC usually provides C code

that is close to what is needed. These listings can be quite valuable as references in planning a conversion strategy, and in some cases BASIC\_C may be used to revise the BASTOC C code rather than completely rewriting it.

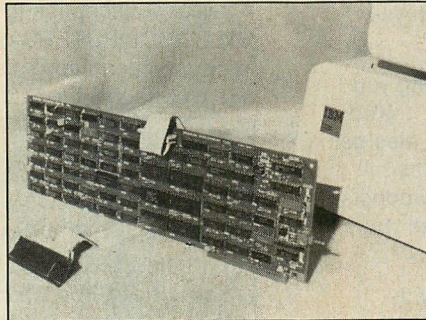
Although the process of translating programs from BASIC to C is hardly a matter of a quick pass through a code generator, BASIC\_C and BASTOC are two welcome additions in the C environment that make it far easier than before to move programs between these two very popular programming languages.



## DEVELOP BETTER SOFTWARE FASTER

WITH *Answer Software's*

### PROGRAM DEVELOPMENT TOOL (PDT-PC)



for IBM-PC\* and Compatibles

**PDT-PC TRANSFORMS YOUR IBM-PC/XT INTO THE MOST POWERFUL DEBUGGING AND ANALYSIS TOOL AVAILABLE FOR THE PC ENVIRONMENT:**

- SYMBOLIC DEBUGGING AND ANALYSIS
  - LOCAL AND GLOBAL SYMBOLS
  - HIGH-LEVEL LANGUAGE LINE NUMBERS
  - FULL SYMBOLIC SUPPORT FOR OVERLAYS AND CODE MODULES
- SUPPORTS BOTH INTEL AND PC-DOS OBJECT MODULE FORMATS
- DISPLAY BUFFER TO RECALL UP TO 200 LINES OF INFORMATION
- INTUITIVE HUMAN INTERFACE
- REAL-TIME PROGRAM EXECUTION MEASUREMENT
- REAL-TIME MEMORY UTILIZATION MEASUREMENT
- STANDARD IN-CIRCUIT EMULATOR FEATURES

**ONLY THE PDT-PC INTEGRATES A FULL-FEATURED DEBUGGER WITH AN 8088 EMULATOR AND PERFORMANCE ANALYSIS, PROVIDING A SINGLE ANSWER TO YOUR MOST DIFFICULT SOFTWARE DEVELOPMENT PROBLEMS!!!**

**Answer Software**  
Corporation

20863 Stevens Creek Blvd., B2-C, Cupertino, CA 95014  
(408) 253-7515

\*IBM-PC is a registered trademark of International Business Machines Corporation

CIRCLE NO. 206 ON READER SERVICE CARD

#### BASIC\_C

C Source Inc.

12801 Frost Road

Kansas City, MO 64138

816-353-8808

\$175 (including source code)

CIRCLE 494 ON READER SERVICE CARD

#### BASTOC

JMI Software Consultants Inc.

P.O. Box 481

Spring House, PA 19477

215-628-0840

\$350

Source code: \$15,000

CIRCLE 495 ON READER SERVICE CARD

#### Recommended Books

Kernighan, B., and D. Ritchie,  
*The C Programming Language*,  
Englewood Cliffs: Prentice-Hall,  
1978.

Plum, Thomas, *Learning to Program  
in C*, Cadiff, NJ: Plum Hall,  
1983.

Purdum, Jack, *C Programming  
Guide*, Indianapolis: Que Corpo-  
ration, 1983

Purdum, Jack, *C Programmers  
Library*, Indianapolis: Que Cor-  
poration, 1984.



# THE WORD CONNECTION FILE



## 8" DISKETTE SYSTEM FOR THE IBM PC

8" Diskette file exchange between the IBM PC and most micro-mini-mainframe computer systems.

8" Diskette text document exchange between the IBM PC and many word processing systems.

8" Diskette to 5¼" formats for hundreds of other systems, even Textpack and Wordstar to the new DisplayWrite 2 format.

FLAGSTAFF ENGINEERING / P. O. Box 1970 / Flagstaff, AZ 86002  
Telephone 602-774-5188 / Telex 705609 FLAG-END-UD

CIRCLE NO. 213 ON READER SERVICE CARD

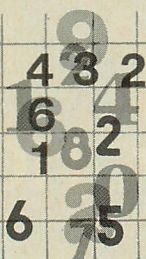


# GAUSS™

## MATRIX PROGRAMMING LANGUAGE

GAUSS is a sophisticated matrix programming package that lets you do large scale number crunching on an IBM-PC.\*

- **EXTREMELY FAST.** Makes direct use of the 8087 numeric co-processor.
- **STATE-OF-THE-ART** numerical routines and random number generators.
- **FULL-FEATURED.** Excellent for statistics, for simulations, for solving non-linear simultaneous equations, and for anything else requiring number crunching.



- **EASY TO LEARN.** Lets you write routines almost exactly as you would write them mathematically.
- **POWERFUL.** Write complex numerical routines in a fraction of the time and with a fraction of the code they would take in Fortran, Basic, or even APL.

### SPECIAL INTRODUCTORY OFFER

With 30 Day Money

Back Guarantee ..... Reg. 395.00 **\$250<sup>00</sup>**

plus \$5.00 shipping and handling.

Call or Write

**APPLIED  
TECHNICAL  
SYSTEMS**

P.O. Box 6487, Kent, WA 98064  
(206) 631-6679

Dealer inquiries welcomed

VISA and  
MASTERCARD  
accepted.

GAUSS requires an IBM PC with at least 256K RAM, an 8087 NDP, 1 DS/DD disk drive, DOS 2.0 (or above). (Contact us about a version that does not require the 8087).

\* IBM is trademark of IBM Corporation.

CIRCLE NO. 104 ON READER SERVICE CARD

## 9-TRACK MAG. TAPE SUBSYSTEM for the IBM PC

For information interchange, backup and archival storage, IBEX offers a 9-track, IBM format-compatible 1/2" magnetic tape subsystem for the IBM PC, featuring:

- 42 M-Bytes on a single reel.
- Automatic loading.
- IBM format 1600 cpi.
- Software for PC-DOS, MS-DOS or CPM-86.

Write, phone or TWX  
for information



**IBEX COMPUTER CORP.**

20741 Marilla Street,  
Chatsworth, CA 91311  
(818) 709-8100  
TWX 910-493-2071

CIRCLE NO. 124 ON READER SERVICE CARD

## BASIC TO C

### Listing 1 BASIC Source for Loan Payment Calculation Program

```

100 GOSUB 800
110 REM
120 REM ***** PRINTS COLUMN LINES *****
130 REM
140 FOR T=1 TO 18
150 PRINT TAB(5);
160 GOSUB 860
170 NEXT T
180 REM
190 REM
200 ANSWER$ = "YES"
210 WHILE ANSWER$ = "YES" OR ANSWER$ = "yes"
220 LOCATE 24,5
230 REM ***** PROMPTS USER FOR INFORMATION *****
240 INPUT; "PRINCIPAL - ",TEMP
250 IF TEMP<>0 THEN ORG.PRNCPL=TEMP
260 INPUT; " NO. OF MONTHS - ",TEMPOR
270 IF TEMPOR<>0 AND TEMPOR<19 THEN MNTHS=TEMPOR ELSE GOTO 210
280 INPUT; " INTEREST RATE - ",TEMP
290 IF TEMP<>0 THEN INT.RATE=TEMP
300 CLS
310 LOCATE 1,1
320 GOSUB 800
330 REM
340 REM ***** CALCULATES VALUES FOR COLUMNS *****
350 REM
360 MINT.RATE = INT.RATE/1200
370 CUM.INT = 0
380 WT.FCTR = (1-(1/(1+MINT.RATE)*MNTHS))
390 MNTH.PYMT = MINT.RATE*ORG.PRNCPL/WT.FCTR
400 PRNCPL = ORG.PRNCPL
410 REM
420 REM ***** CALCULATES VALUES FOR EACH MONTH *****
430 REM
440 FOR N=1 TO MNTHS
450 INT.PYMT = PRNCPL*MINT.RATE
460 PRNCPL.PYMT = MNTH.PYMT-INT.PYMT
470 CUM.INT=CUM.INT+INT.PYMT
480 PRINT TAB(7);
490 PRINT USING "## |";N;
500 PRINT TAB(13);
510 PRINT USING "####,## |";PRNCPL;CUM.INT;INT.PYMT;
520 PRINT USING "####,##";PRNCPL.PYMT;MNTH.PYMT
530 PRNCPL = PRNCPL-PRNCPL.PYMT
540 NEXT N
550 LOCATE 23,5
560 INPUT "DO YOU WISH TO MAKE ANY CHANGES"; ANSWER$
570 WEND
580 END
590 REM
600 REM ***** PRINTS THE HEADER *****
610 REM
800 PRINT
810 PRINT TAB(12) " | " TAB(25) " | " CUMULATIVE | INTEREST " ;
815 PRINT "PRINCIPAL MONTHLY"
820 PRINT TAB(4) "MONTH | PRINCIPAL | INTEREST | PAYMENT";
825 PRINT " + PAYMENT = PAYMENT"
830 X$ = STRING$(72,95)
840 PRINT TAB(4);X$:PRINT TAB(5)
850 RETURN
860 PRINT TAB(12) " | " TAB(25) " | " TAB(38) " | " TAB(51) " | " TAB(64) " | "
870 RETURN

```

Reproduced with permission from C Source Inc. ©1984.

### Listing 2 BASIC\_C Output for Loan Payment Calculation Program

```

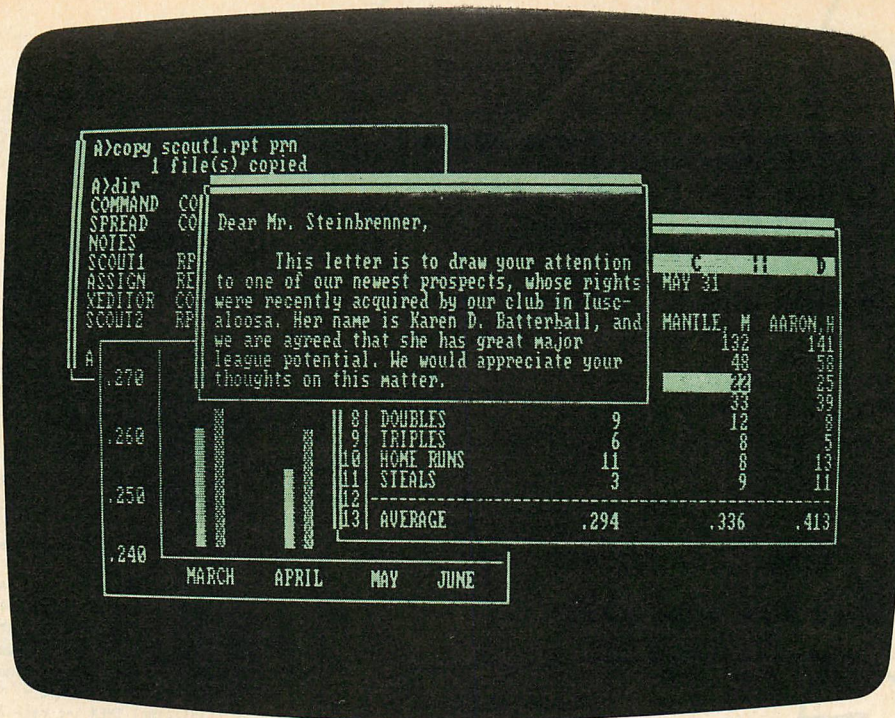
#include <bas.h>

main()
{
    INT t;

    /* ***** prints column lines ***** */
    INITBC();

```





## SOFTWARE FUSION

# APX

## CORE EXECUTIVE™

### INTEGRATE VIRTUALLY ANY SOFTWARE

The APX CORE EXECUTIVE enables you to:

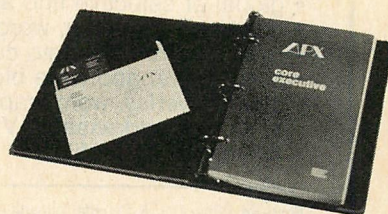
- ★ Run several programs simultaneously.
- ★ Control each program through interactive windows.
- ★ Change any window's size and position, and scroll within any window.
- ★ "Cut & paste" from one window to another automatically.
- ★ Save typed sequences for replay with a single keystroke.

All this, and more..... **\$195.00**

The APX CORE EXECUTIVE  
(available for the IBM PC with DOS).

**Application  
Executive  
Corporation**

600 Broadway  
Suite 4C  
New York, NY 10012  
(212) 226-6347



# APX

Dealer inquiries invited.

CIRCLE NO. 192 ON READER SERVICE CARD



## Scroll & Recall™

**Screen and Keyboard Enhancement**  
for the IBM - PC, XT and Compatibles

Allows you to conveniently scroll back through data that has gone off the top of your display screen.

Allows you to easily recall and edit your previously entered DOS commands and data lines.

Very easy to use, fully documented. Compatible with all versions of DOS, monochrome & graphic displays.

**\$69** - Visa, M/C, Check, COD, POs  
Phone orders accepted

**Make Your Work Easier!**

To Order or to Receive Additional  
Information, Write or Call:

**Opt-Tech Data Processing**

P.O. Box 2167 • Humble, Texas 77347

(713) 454-7428

Dealer Inquiries Welcome

CIRCLE NO. 196 ON READER SERVICE CARD

## MicroScript™ \$50

Customizable Text Formatter

- headers, footers, footnotes
- top and bottom page floats
- multiple columns with column balancing
- top and bottom column floats
- keeps, widow and orphan suppression
- table of contents, index
- boxes, lists, section numbering
- generalized indentation and text attributes
- macros, symbols, conditional processing
- mail merge, character parse or fixed fields
- full path support (PC-DOS\* 2.0+)
- all ASCII printers
- customize by profile

## MicroEd™ \$50

Customizable Full Screen Editor

- full cursor control by character, word, or line
- position to top or bottom of window or file
- scroll by line or window
- global or selective find and replace
- delete by character, word, line, or block
- read external files into current file
- copy, move, and write blocks of text
- insert, overlay, wordwrap, split, or join
- all cursor addressable VDTs
- customize by profile

Postpaid within U.S. & Canada, outside U.S. add \$5, CA residents add 6½%,  
8" SS/SD CP/M-86\*, 8" SS/SD CP/M-68K\*, 5.25" DS/DD PC-DOS 2.0+.\*



6531 Crown Blvd., Suite 3A, San Jose, CA 95120  
(408) 997-5026

**MicroType™**



\* CP/M-86, CP/M-68K, are trademarks of Digital Research, PC-DOS is a trademark of IBM Corporation.

CIRCLE NO. 145 ON READER SERVICE CARD

## BASIC TO C

```
header();
for (t = 0; t < 18; t++){
    PRINT("T:", 5);
    prt_column();
}

calc_pymt();
}

calc_pymt()
{
    INT mnths, n, tempor;
    DBL temp, org_prncpl, int_rate, mint_rate, cum_int, power();
    DBL prncpl, int_pymt, prncpl_pymt, wt_fctr, mnth_pymt;
    STR answer;

    answer = "YES";
    while (CMP(answer, IS_EQ, "YES") OR CMP(answer, IS_EQ, "yes")){
        LOCATE(24, 5);

        /*
            ***** prompts user for information *****
        */

        INPUT("PRINCIPAL - ", ";D", &temp);
        IF ((INT)temp) THEN org_prncpl = temp;
        INPUT(" NO. OF MONTHS - ", ";I", &tempor);
        IF (tempor > 16) THEN continue;
        IF (tempor) THEN mnths = tempor;
        INPUT(" INTEREST RATE - ", ";D", &temp);
        IF ((INT)temp) THEN int_rate = temp;
        CLS();
        LOCATE(1,1);
        header();
        prt_column();

        /*
            ***** calculates values for columns *****
        */

        mint_rate = int_rate/1200;
        cum_int = 0;
        wt_fctr = (1-(1/power((1 + mint_rate), mnths)));
        mnth_pymt = mint_rate * org_prncpl / wt_fctr;
        prncpl = org_prncpl;

        /*
            ***** calculates values for each month *****
        */

        for (n = 1; n <= mnths; n++){
            int_pymt = prncpl * mint_rate;
            prncpl_pymt = mnth_pymt - int_pymt;
            cum_int = cum_int + int_pymt;
            PRINT("T:", 7);
            PRINT USING("----|:", 1, n);
            PRINT("T:", 13);
            PRINT USING("#####.##|:", 4, prncpl, cum_int, int_pymt,
                prncpl_pymt);
            PRINT USING("#####.##;", 1, mnth_pymt);
            prncpl = prncpl - prncpl_pymt;
        }
        LOCATE(23, 5);
        INPUT("DO YOU WISH TO MAKE ANY CHANGES? ", "S", &answer);
    }
}
```

Reproduced with permission from C Source Inc. ©1984.

## Listing 3 BASIC Source for Inventory Program

```
10 OPEN "R", 1, "INVENTORY", 34
20 PRINT "MENU"
30 PRINT "1: ADD A NEW ITEM"
40 PRINT "2: RETRIEVE AN ITEM"
50 PRINT "3: CHANGE AN ITEM"
60 PRINT "4: DELETE AN ITEM"
70 PRINT "5: FINISH"
80 INPUT "YOUR CHOICE";X
90 ON X GOSUB 110,140,170,220,270
100 GOTO 20
110 GOSUB 290
120 GOSUB 330 : GOSUB 390
130 RETURN
140 GOSUB 290
150 GOSUB 450
```



```

160 RETURN
170 GOSUB 140
180 PRINT "NEW DATA"
190 GOSUB 330
200 GOSUB 390
210 RETURN
220 GOSUB 140
230 DE$ = "DELETED"
240 INPUT "OK TO DELETE (Y/N)";AN$
250 IF AN$ = "Y" THEN GOSUB 390
260 RETURN
270 CLOSE
280 END
290 INPUT "INVENTORY NUMBER";IN
300 FIELD 1,20 AS A$,8 AS B$,4 AS C$,2 AS D$
310 GET 1,IN
320 RETURN
330 LINE INPUT "DESCRIPTION? ";DE$
340 DE$ = LEFT$(DE$, 20)
350 INPUT "QUANTITY";QU%
360 INPUT "PRICE";PR#
370 INPUT "COST";CO!
380 RETURN
390 RSET A$=DE$
400 LSET B$=MKD$(PR#)
410 LSET C$=MKS$(CO!)
420 LSET D$=MKI$(QU%)
430 PUT 1, IN
440 RETURN
450 IF RIGHT$(A$,7) = "DELETED" THEN PRINT "DELETED" : RETURN
460 PRINT "DESCRIPTION";TAB(22);"PRICE";TAB(30);"COST";TAB(38);"QUANTITY"
470 PRINT A$;TAB(22);CVD(B$);TAB(30);CVS(C$);TAB(38);CVI(D$)
480 RETURN

```

### Listing 4 BASTOC Output for Inventory Program

```

char *data_stmts[] =
{

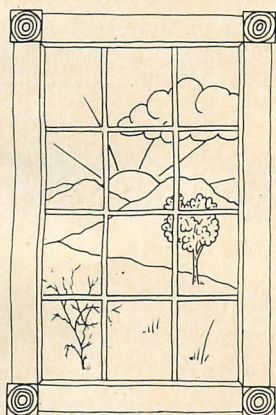
```

```

0
};
extern double brd_num();
extern double CVD();
extern CVI();
extern double CVS();
extern char *FIELD();
extern GET();
extern char *LEFT_();
extern PUT();
extern char *RIGHT_();
extern char *SUBFLD();
extern TAB();
extern char *brd_line();
extern char *brd_str();
extern char *fld_get();
extern char *s_agn();
char * a_ ;
char * an_ ;
char * b_ ;
char * c_ ;
float coF;
char * d_ ;
char * de_ ;
float in;
double prD;
int quI;
float x;
static char nul_str[1] = {0};
static char *st_1 = nul_str, *st_2 = nul_str;
static char *fl_1 = 0;
main(argc, argv)
int argc;
char *argv[];
{
    bio_init(argc, argv);
    bassoc("INVENTORY",1);
    bda_fset(1, 34);
    l_20;
    bwr_set(1);

```

**NEW Ver. 2.2**  
**Easier — More Power**



## WINDOWS FOR C™

FOR THE IBM PC + COMPATIBLES  
Lattice C, CI-C86, MWC86  
DeSmet C, Microsoft C

**WINDOWS FOR C** \$150  
(specify compiler & version)  
**Demo disk and manual** \$ 30  
(applies toward purchase)  
**Dealer Inquires welcome**

## C ADVANCED SCREEN MANAGEMENT MADE EASY

### ADVANCED FEATURES

- Unlimited windows and text files
- Word wrap, auto scroll
- Horizontal and vertical scroll
- Fast! + No flicker or snow
- No memory in screen buffers
- Complete color control
- Auto memory management
- Save and move window images
- Easy overlay and restore
- Format and print with windows
- Highlighting

### WINDOWS++

Much more than a window display system, **Windows for C** is a video display toolkit that simplifies all screen management tasks.

### SIMPLIFY • IMPROVE

- Menus
- Data screens
- Form printing
- Help files
- Editors
- Games

### ALL DISPLAYS

#### C SOURCE MODULES FOR

pop-up menus, multiple window displays, label printer, cursor control, text mode bar graphs.  
**plus complete building block subroutines**

### DESIGNED FOR PORTABILITY

**FULL SOURCE AVAILABLE  
NO ROYALTIES**

A PROFESSIONAL SOFTWARE TOOL FROM

**CREATIVE SOLUTIONS**

21 Elm Ave, Box T10, Richford, VT 05476

**802-848-7738**

Master Card & Visa Accepted  
Shipping \$2.50  
VT residents add 4% tax



## Waterloo NetWorkStation Tools

for the IBM Personal Computer

### Editor

- full-screen
- colour support
- function keys

### Host Communications

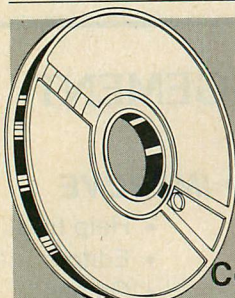
- VM/370 CMS, RSTS/E, VAX/VMS
- file transfer micro to/from host
- access host files from micro programs

### Terminal Emulation

For further information contact:

WATSOFT Products Inc. (519) 886-3700  
158 University Ave. W., Telex No.: 06-955458  
Waterloo, Ontario  
N2L 3E9

CIRCLE NO. 218 ON READER SERVICE CARD



## 9 TRACK TAPE CONTROLLER

New 1/2" Tape  
Controller for the IBM-PC

TC-PC is a high performance tape controller for the IBM-PC with these important features:

- Capable of reading and writing industry standard 1/2" tape
- Comprehensive software tools supplied
- 8 bit parallel recording with parity and read-after-write verification of data
- Compatible with most nine track formatted tape drives
- Operates with tape drive speeds up to 120 inches per second; allows data transfer rates of up to 192,000 bytes per second
- Economically priced at \$880

For more information on the TC-PC, call or write today.

Dealer/Distributor inquiries invited.

**OVERLAND DATA, INC.**

5644 Kearny Mesa Rd., Suite A  
San Diego, CA 92111  
Tel. (619) 571-5555

CIRCLE NO. 185 ON READER SERVICE CARD

## BASIC TO C

```

bwr_str("MENU", 0);
bwr_n1();
bwr_set(1);
bwr_str("1: ADD A NEW ITEM", 0);
bwr_n1();
bwr_set(1);
bwr_str("2: RETRIEVE AN ITEM", 0);
bwr_n1();
bwr_set(1);
bwr_str("3: CHANGE AN ITEM", 0);
bwr_n1();
bwr_set(1);
bwr_str("4: DELETE AN ITEM", 0);
bwr_n1();
bwr_set(1);
bwr_str("5: FINISH", 0);
bwr_n1();
do
{
    bwr_prompt("YOUR CHOICE",0);
    brd_set(0, 1);
    x = brd_num();
    } while(brd_err());
switch(CINT(x))
{
    case 1: pr_110(); break;
    case 2: pr_140(); break;
    case 3: pr_170(); break;
    case 4: pr_220(); break;
    case 5: pr_270(); break;
}
goto 1_20;
}

pr_110()
{
    pr_290();
    pr_330();
    pr_390();
    return;
}

pr_140()
{
    pr_290();
    pr_450();
    return;
}

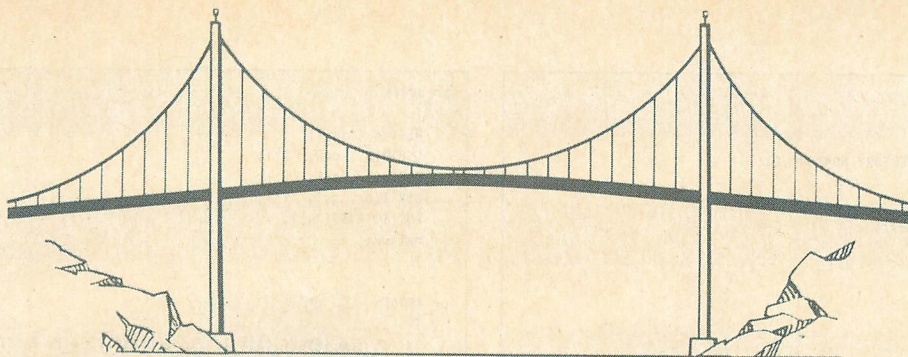
pr_170()
{
    pr_140();
    bwr_set(1);
    bwr_str("NEW DATA", 0);
    bwr_n1();
    pr_330();
    pr_390();
    return;
}

pr_220()
{
    pr_140();
    de = s_asgn(de, "DELETED");
    do
    {
        bwr_prompt("OK TO DELETE (Y/N)",0);
        brd_set(0, 1);

        an = brd_str(an);
        } while(brd_err());
    if(-(s_comp(an,"Y")==0))
    {
        pr_390();
    }
    return;
}

pr_270()
{
    bclall();
    bexit(0);
}
    
```





# PELADA TEXT ENGINEER

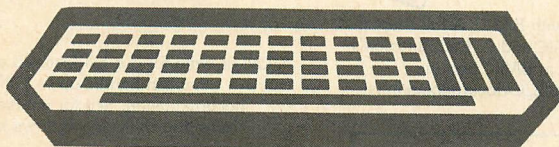
The first full featured word processor for the IBM personal computer capable of producing all mathematical, scientific and engineering symbols\* including superscripts and subscripts for complete equation editing on screen.

Multi-lingual capabilities include the specific characters, accents and letters found in French, Spanish, German, Italian and all other western European languages.

Advanced Word Processing features include:

- Command line driven editor
- Comprehensive, easily accessible on-line help
- All features, including bold, italics, underlining and special characters appear on screen exactly as they are printed.

SPECIAL INTRODUCTORY PRICE \$250 MAIL ORDER ONLY. OFFER EXPIRES JULY 31/84.



## PELADA INFORMATICA INC.

87 Queen St., Kingston, Ontario,  
Canada K7K 1A5  
Tel. (613) 549-1747

\*Requires Epson FX-80, FX-100 or similarly featured printer.

**FREE SAMPLE DISK AVAILABLE UPON REQUEST.**

CIRCLE NO. 141 ON READER SERVICE CARD



# BASIC TO C

```
pr_290()
{
do
{
bwr_prompt("INVENTORY NUMBER",0);
brd_set(0, 1);
in = brd_num();
} while(brd_err());
f1_1 = FIELD(f1_1, 1, 4);
a_ = SUBFLD(20);
b_ = SUBFLD(8);
c_ = SUBFLD(4);
d_ = SUBFLD(2);
GET(1, CINT(in));
return;
}
```

```
pr_330()
{
bwr_prompt("DESCRIPTION? ",0);
brd_set(0, 0);
de_ = brd_line(de_);
de_ = s_asgn(de_, LEFT(&st_1, de_, 20));
do
{
bwr_prompt("QUANTITY",0);
brd_set(0, 1);
quI = brd_int();
} while(brd_err());
do
{
bwr_prompt("PRICE",0);
brd_set(0, 1);
prD = brd_num();
} while(brd_err());
do
{
bwr_prompt("COST",0);
brd_set(0, 1);
coF = brd_num();
} while(brd_err());
return;
}
```

```
pr_390()
{
RSET(a, de_);
LSETD(b, prD, 'D');
LSETD(c, coF, 'S');
LSETI(d, quI, 'I');
PUT(1, CINT(in));
return;
}

pr_450()
{
if((-s_comp(RIGHT(&st_1, fld_get(&st_2, a_), 7),"DELETED")==0))
{
bwr_set(1);
bwr_str("DELETED", 0);
bwr_nl();
return;
}
bwr_set(1);
bwr_str("DESCRIPTION", 0);
TAB(22);
bwr_str("PRICE", 0);
TAB(30);
bwr_str("COST", 0);
TAB(38);
bwr_str("QUANTITY", 0);
bwr_nl();
bwr_set(1);
bwr_str(fld_get(&st_1, a_), 0);
TAB(22);
bwr_num(CVD(b_), 0);
TAB(30);
bwr_num(CVS(c_), 0);
TAB(38);
bwr_int(CVI(d_), 0);
bwr_nl();
return;
}
```

## BASIC C™ LIBRARY— BRIDGING THE BASIC GAP

Every day, programmers like yourself are making the jump from BASIC to C. With high level functions that work like BASIC and documentation that is written from the perspective of a BASIC programmer, the BASIC\_C library provides the best path to help make your journey pleasant and fast!

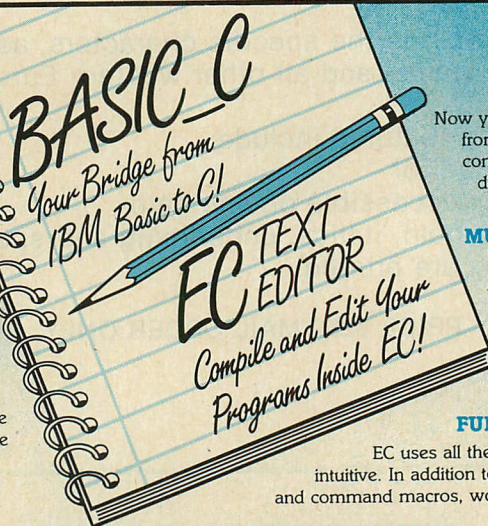
## BASIC'S POWERFUL FUNCTIONS IN C PROGRAMS

The BASIC\_C library provides most of BASIC's high level functions—string handling, sequential and random i/o, graphics and many more—all are designed to look and work like BASIC functions. Instead of wasting time trying to figure out how to clear a screen or locate the cursor, you can concentrate on learning what C is about. Source code for the whole library is included!

## WRITTEN WITH BASIC PROGRAMMERS IN MIND

Our documentation is oriented to those familiar with BASIC. A full chapter is devoted to a point-by-point comparison of BASIC and C. Each function's description contains at least one example written in BASIC and the equivalent C. Many customers tell us that the BASIC\_C documentation is the best C tutorial they've seen.

EC DEMO DISK - .....	\$ 5
EC (pronounced e-see) - full screen editor .....	\$125
BASIC_C LIBRARY - including source code .....	\$175
BASIC_C & EC .....	\$275
BASIC_C & DeSmet C compiler/w debugger .....	\$325
BASIC_C & Computer Innovations C compiler .....	\$475
BASIC_C & Lattice C compiler .....	\$525
BASIC_C & EC & DeSmet C compiler/w debugger ..	\$425
BASIC_C & EC & Computer Innovations C compiler .....	\$575
BASIC_C & EC & Lattice C compiler .....	\$625



## EC SCREEN EDITOR— MAKE ANY PC-DOS CALL FROM INSIDE EC

Now you can edit, compile and test your program from inside the EC editor. In fact, EC gives you complete access to the operating system. Do a directory, copy or delete files, even run other programs without ever leaving EC!

## MULTIPLE WINDOWS ... WITH A FILE IN EACH

All windows can be shown on the screen at the same time; or the screen can be dedicated to one file, while the others are kept in the background—only a keystroke away. You can even cut and paste blocks of text between windows!

## FULL SCREEN EDITOR FOR THE IBM—

EC uses all the PC's special keys so that editing is fast and intuitive. In addition to standard editing features, EC provides text and command macros, word wrap, paragraph reformatting, horizontal scrolling, and color video control.

## DEMO DISK IS ONLY \$5—

Call or write for our full-featured demo. You'll get a standard version of EC that can handle up to 10K worth of text files and a complete set of documentation. See for yourself how pleasant it is to use an editor that gives you multiple windows and free access to your operating system.

\*BASIC\_C and EC run on an IBM PC, or look-alike, with at least 128K RAM under DOS 1.1 or higher. To use the EC EDITOR'S DOS interface feature you must have DOS 2.0 or higher and enough RAM to run the additional program.

IBM is a trademark of International Business Machines.  
MO. Residents Add 6% Sales Tax.



**C SOURCE**  
12801 Frost Road  
Kansas City, MO 64138  
**816-353-8808**



# NOVATION TALKS BUSINESS

## Introducing the LSI Cat Communication System™ with the Hayes compatible 300/1200 Smart-Cat**Plus**™ modem.

No more wondering what goes with what. Here's the best modem and the best software for your specific computer—all in one package.

Will your computer take an internal modem? Or do you prefer a stand-alone? And which operating system do you need—CP/M, CP/M-86, PC-DOS, MS-DOS? The Cat System includes them all.

And no compromises.

The quality starts with our new Smart-Cat PLUS modem. There is absolutely nothing else to equal it on the market. You get faster more accurate dialing. Automatic self-testing of the full communications circuit. State-of-the-art advanced LSI circuitry. And more. It is simply the best there is.

CIRCLE NO. 103 ON READER SERVICE CARD

The software is MITE™—menu-driven, easy-to-use, remarkably powerful. It gives you error-free data communications and instant access to Dow Jones, CompuServe and the like.

With the Cat System everything you get is the best of everything—that includes the best price. Suggested retail: \$499.

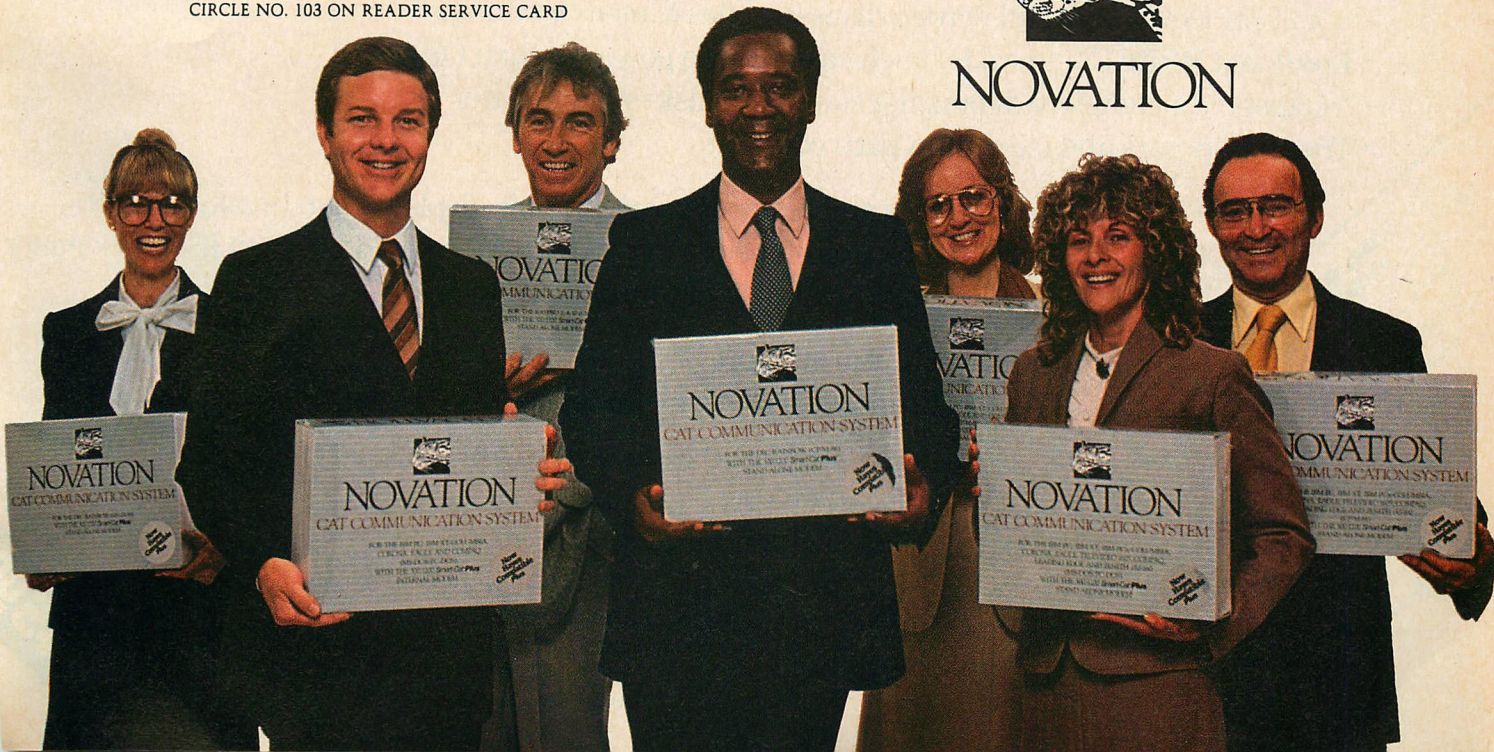
See your dealer. He has them right now.

Seven models covering the IBM-PCs and their look-alikes, DEC Rainbow, KAYPRO and their operating systems. More models to come.

Novation, Inc., Box 2875  
20409 Prairie Street, Chatsworth, CA 91311  
(800) 423-5419 • In California: (818) 996-5060



## NOVATION





### CodeSmith™-86

B:\fabcode.COM CodeSmith-86

>

Also runs on some IBM-PC Compatibles

AX=8086	SP=8087	SS=1983
BX=0000	BP=0000	DS=1984
CX=0000	SI=0000	ES=1985
DX=1138	DI=0000	CS=2001
		IP=0001

PL	ZR	NC	NV	UP	NA	PE	EI
----	----	----	----	----	----	----	----

```

2001:0000  53          24 IO_INIT:  PUSH  BX          ;TAG A LINE
2001:0001  9BDEC2          FADDP  ST(2),ST
2001:0004  BB3100          MOV    BX,Offset VECTOR_TABLE_2
2001:0007  803E5E~      34      CMP    DOS_VERSION_NUM,'2' ;BREAKPOINT SET
2001:000C  7305          JAE     TRASH_IT
2001:000E  BB0100          MOV    BX,Offset VECTOR_TABLE_1
2001:0011  EB02          JMP     Short LONG_LABELS_ARE_OK_AS_YOU_LIKE
2001:0013  F2AB  00777  TRASH_IT:  REPNZ  STOSW          ;STOP 777th TIME
2001:0015          LONG_LABELS_ARE_OK_AS_YOU_LIKE:
2001:0015  8DAD63~      LEA     BP,WIERD_CODE + 2[DI]
2001:0019  240C          AND     AL,00011100B          ;CHANGE RADIX
2001:001B  45          DB     69
  
```

MEMORY DUMP

>>DOS\_VERSION\_NUM Absolute Address=03C9E Segment:Offset=03C4:005E

```

1984:0050  41 53 43 49 49 20 53 55-50 50 4F 52 54 20 32 20 ASCII SUPPORT 2
1984:0060  20 2D 2D 2D 43 6F 64 65-53 6D 69 74 68 2D 38 36 -- CodeSmith-86
1984:0070  20 4D 41 4B 45 53 20 44-45 42 55 47 47 49 4E 47 MAKES DEBUGGING
1984:0080  20 41 2D 42 4C 41 53 54-21 2D 2D 2D 2D 2D 2D 2D A BLAST!
  
```

WNOW 2 LVL 1

It's here—THE Multi-Window Interactive Debugger that's STATE-OF-THE-ART.

- Scroll Up/Down thru full-screen disassemblies & memory dumps
- **Load** and **Write** Commands much easier, more powerful than DEBUG's
- "Snapshot" a complete debugging state onto disk—resume later
- True passpoints and execution path counters
- SCREENSAVE mode saves and restores user's graphic display when breakpoint hit
- Disassemble selected ranges of memory code to disk—compatible with IBM Assembler
- Stop on data Read/Write or memory range access

Hot-Line technical support

**The Professional's Choice—CodeSmith-86**

Multiple copies purchased by:

Lotus Development Corp., MicroPro, VisiCorp, IBM.

Requires MS-DOS & 160K RAM.

OEM and dealer inquiries invited.

**VISUAL AGE**

642 N. Larchmont Blvd. • Los Angeles, CA 90004

CIRCLE NO. 140 ON READER SERVICE CARD

CodeSmith, TM International Arrangements, Inc.

MS, TM Microsoft Corp.

IBM, TM International Business Machines Corp.

Send **VISUAL AGE** - 642 N. Larchmont Blvd. L.A., CA 90004 • (213) 439-2414  
 Name **CodeSmith-86** @ \$145 + \$4 shipping (each) • California residents add 6.5% sales tax.  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Acct. No. \_\_\_\_\_ Phone \_\_\_\_\_  
 Exp. Date \_\_\_\_\_  
☐ VISA ☐ MasterCard  
☐ Payment Enclosed  
☐ COD

CALL (213) 439-2414  
**\$145.00**





## IBM PC MODEM

CROSSTALK<sup>™</sup>

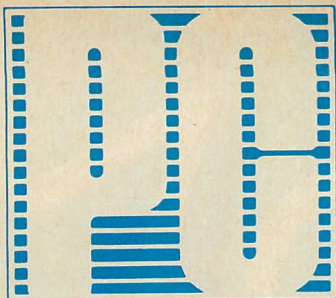
XCOM is an internally mounted, 300/1200 bps modem that includes CROSSTALK XVI communications software. Designed for use in the IBM PC and compatibles, XCOM comes with everything you need for your PC to start communicating with other computers: user's manual, CROSSTALK diskette, telephone cable, card guide and even a 2 year warranty. XCOM automatically selects between tone and pulse dialing, checks for dial tone, detects ring-back signals and reports busy signals — an ease of use unheard of before. The simulated speaker function allows you to listen to your calls without watching your screen. Our switch-to-voice capability lets you use your PC for voice calls and for auto-dialing your frequently used numbers.

CROSSTALK XVI software, the industry standard, assures error-free file transfers with most microcomputer communication systems. A user-defined procedure, with a single command, configures the hardware, initiates the call, and logs in. With CROSSTALK, the IBM PC or compatibles can emulate some of the industry's more popular terminals. Our price, \$449, plus our unique features, makes XCOM the intelligent choice. Contact us for the dealer/distributor in your area.

**COM**  
Delta Communication  
Products, Inc.  
3213 Ramos Circle  
Sacramento, CA 95827  
Telephone: 916-366-7071

CIRCLE NO. 187 ON READER SERVICE CARD





# PC WEEK

**THE NEWS  
WEEKLY FOR  
IBM SYSTEM  
MICRO  
COMPUTERS**

The first weekly newspaper designed to  
give key executives the latest  
IBM Personal Computer news and analyses—  
*as soon as it happens!*

To keep your company in the forefront of today's rapidly changing IBM Personal Computer technology, you need timely information. Information that's clearly written, bringing you the news the way you need it, when you need it. You need PC WEEK.

PC WEEK is the first and only weekly newspaper devoted to IBM Personal Computer news—with the latest breaking stories as they develop.

PC WEEK follows and reports the news—up to 48 hours before publication—so you learn what's new *when* it's new! You'll find research updates, strategic analysis, new hardware and software reviews, insights on future industry concerns and controversies, and the timely information you need to help make you more productive and efficient.

Every week you'll find outstanding features and departments covering...

- **NEWS:** PC WEEK brings you analytical reports on the major topics of the day. Product announcements and

company changes are analyzed and put into perspective, helping you plan for future investments and developments.

- **STRATEGIES:** Every week you get an in-depth profile of a leading user company and how they use their IBM and compatible personal computers. Case studies help you evaluate the success and failure of new applications—some you even may have been considering.

- **INDUSTRY TRENDS:** Discover what's happening behind the scenes in new product development from both hardware and software manufacturers and what this could mean to the future of your company.

- **PRODUCT REVIEWS:** In-depth reviews of important new hardware and software releases tell you what product is right for your operation, and the technical and financial considerations involved.

- **FOCUS ON:** The latest news and events in specific product areas are detailed every week. We cover file systems, 3270 products, graphics software, input hardware, database managers, program generators, multifunctional applications—the information you need for your IBM installation.

- **BUYERS GUIDES:** Special sections with careful evaluations and comparative charts to help you select the proper peripherals and software packages for your operation. From word processing to local area networks or compatibles, you'll find complete and unbiased reviews and listings.

Your subscription to PC WEEK is complimentary if you qualify. Take a moment, fill out the Qualification Form at right and return it to PC WEEK today.

PC WEEK, your vehicle to stay in the forefront of tomorrow's IBM Personal Computer technology.

**PC WEEK**

Get the news you need every week, *first hand*, with PC WEEK.



## Complimentary Subscription Application

YOU MUST ANSWER ALL QUESTIONS TO QUALIFY.

1. ☐ Please accept my request for a complimentary subscription to PC WEEK.
2. ☐ No, I do not want to receive PC WEEK.
3. Primary business activity of your firm at this location (check one only):

- |  |  |
|--|--|
| <input type="checkbox"/> 1. Manufacturing of computer equipment, computers, DP hardware, peripherals | <input type="checkbox"/> 9. Finance, banking, insurance, real estate |
| <input type="checkbox"/> 2. Manufacturing other  | <input type="checkbox"/> 10. Health, medical service                 |
| <input type="checkbox"/> 3. Agriculture, mining, construction  | <input type="checkbox"/> 11. Legal                                   |
| <input type="checkbox"/> 4. Transportation   | <input type="checkbox"/> 12. Education                               |
| <input type="checkbox"/> 5. Communications   | <input type="checkbox"/> 13. Data processing, computer service       |
| <input type="checkbox"/> 6. Utilities  | <input type="checkbox"/> 14. Other business services                 |
| <input type="checkbox"/> 7. Computer related retailer  | <input type="checkbox"/> 15. Government                              |
| <input type="checkbox"/> 8. Non-computer related retailer or wholesaler                              | <input type="checkbox"/> 16. Consultant                              |
|  | <input type="checkbox"/> 17. Other (please specify)                  |

4. Your title: (Check one appropriate box)

- |   |  |
|---|--|
| <input type="checkbox"/> 1. Pres/Owner/Dir/Chmn/Partner   | <input type="checkbox"/> 15. Dir/Mgr EDP/MIS Operations          |
| <input type="checkbox"/> 2. Vice-Pres/Gen Mgr             | <input type="checkbox"/> 16. Dir/Mgr Information Ctr             |
| <input type="checkbox"/> 3. Comptroller/Treasurer         | <input type="checkbox"/> 17. Business Microcomputer Specialist   |
| <input type="checkbox"/> 4. Vice-Pres Finance             | <input type="checkbox"/> 18. Systems Analyst                     |
| <input type="checkbox"/> 5. Chief Accountant              | <input type="checkbox"/> 19. Data Base Administrator             |
| <input type="checkbox"/> 6. Vice-Pres Operations          | <input type="checkbox"/> 20. Vice-Pres/Dir R&D                   |
| <input type="checkbox"/> 7. Dir/Mgr Purchasing            | <input type="checkbox"/> 21. Vice-Pres/Dir Engineering           |
| <input type="checkbox"/> 8. Dir/Mgr Office Systems        | <input type="checkbox"/> 22. Dir/Mgr Plant or Prod               |
| <input type="checkbox"/> 9. Vice-Pres Sales/Sales Mgr     | <input type="checkbox"/> 23. Chief Engineer                      |
| <input type="checkbox"/> 10. Dir/Mgr Marketing            | <input type="checkbox"/> 24. Systems Engineer                    |
| <input type="checkbox"/> 11. Dir/Mgr/Chief of EDP/MIS     | <input type="checkbox"/> 25. Design/Production/Research Engineer |
| <input type="checkbox"/> 12. Dir/Mgr Programming          | <input type="checkbox"/> 26. Consultant                          |
| <input type="checkbox"/> 13. Dir/Mgr Systems & Procedures | <input type="checkbox"/> 27. Educator                            |
| <input type="checkbox"/> 14. Dir/Mgr Communications       | <input type="checkbox"/> 28. Other (please be specific)          |

5. Do you have any MAINFRAME computers or MINICOMPUTERS on site at this location?

- ☐ Yes (If yes, please report accurately below for the two largest.)
- ☐ No

Manufacturer	Model	Quantity

### IBM or Compatible Personal (Micro) Computer Information for this location:

(Please report accurately for each model indicated)

Manufacturer's Name, Model	6. Currently Owned (Quantity)	7. Plan To Purchase Within:		
		0-12 Months (Quantity)	13-24 Months (Quantity)	25-36 Months (Quantity)
IBM PC				
IBM PC XT				
IBM XT/370				
IBM PC/3270				
IBM PCjr				
IBM Compatibles (Compaq, Eagle, etc.)				
Other (Not IBM or Compatibles)				

7a. In which of the following ways are you yourself involved with the Personal (Micro) Computers at your location?

- |  |   |
|--|---|
| <input type="checkbox"/> A. Use them                 | <input type="checkbox"/> F. Other Involvement (specify) |
| <input type="checkbox"/> B. Recommend them           |   |
| <input type="checkbox"/> C. Establish specifications |   |
| <input type="checkbox"/> D. Approve purchase         |   |
| <input type="checkbox"/> E. Acquire them             | <input type="checkbox"/> G. No involvement              |

8. The Personal (Micro) Computers purchased for this location would be:

- |  |  |
|--|--|
| <input type="checkbox"/> 1. For internal use | <input type="checkbox"/> 3. Other (please specify) |
| <input type="checkbox"/> 2. For resale       |  |

Full company name and company address must appear in spaces below for application to be processed.

OR AFFIX YOUR BUSINESS CARD

PW 1194

Name	
Title	
Company Name	
Division	Telephone Number
Company Street Address	
Company City	State Zip

8a. How are Personal (Micro) Computers normally obtained for this location?

- |  |  |
|--|--|
| <input type="checkbox"/> A. Direct from manufacturer     | <input type="checkbox"/> E. System house             |
| <input type="checkbox"/> B. Manufacturers representative | <input type="checkbox"/> F. In-house (company) store |
| <input type="checkbox"/> C. Distributor                  | <input type="checkbox"/> Z. Other (please specify)   |
| <input type="checkbox"/> D. Retail computer store        |  |

9. Please indicate below the communications capability for which these Personal (Micro) Computers are used.

- ☐ A. Communicate with remote timesharing or database.
- ☐ B. Communicate with internal mainframe or minicomputer.
- ☐ C. Used in local area network.
- ☐ D. Download data from mainframe or remote service.
- ☐ E. None of the above.

9a. Please indicate below the applications for which these Personal (Micro) Computers are used.

- |   |   |
|---|---|
| <input type="checkbox"/> 1. Accounting              | <input type="checkbox"/> 9. Graphics Design                         |
| <input type="checkbox"/> A. Accounts Payable        | <input type="checkbox"/> 10. Personal Time Management               |
| <input type="checkbox"/> B. Accounts Receivable     | <input type="checkbox"/> 11. Portfolio Management                   |
| <input type="checkbox"/> C. Billing & Collection    | <input type="checkbox"/> 12. Programming                            |
| <input type="checkbox"/> D. General Ledger          | <input type="checkbox"/> 13. Project Management                     |
| <input type="checkbox"/> E. Inventory               | <input type="checkbox"/> 14. Process Control                        |
| <input type="checkbox"/> F. Order Entry & Invoicing | <input type="checkbox"/> 15. Scientific or Engineering Applications |
| <input type="checkbox"/> G. Time Billing            | <input type="checkbox"/> 16. Statistical Analysis                   |
| <input type="checkbox"/> 2. Communications          | <input type="checkbox"/> 17. Tax Calculation or Planning            |
| <input type="checkbox"/> 3. Data Base Management    | <input type="checkbox"/> 18. Word Processing                        |
| <input type="checkbox"/> 4. Data Input/Analysis     | <input type="checkbox"/> 19. Other                                  |
| <input type="checkbox"/> 5. Education               |   |
| <input type="checkbox"/> 6. Electronic Mail         |   |
| <input type="checkbox"/> 7. Entertainment (Games)   |   |
| <input type="checkbox"/> 8. Financial Planning      |   |

10. Do you help acquire, recommend, specify or approve any of the products or services below?

- ☐ Yes (If yes, please check all that apply)

☐ No.

Computers

- ☐ 1. Mainframe
- ☐ 2. Minicomputer
- ☐ 3. Personal (Micro)

Peripheral Equipment

- ☐ 7. Letter Quality Printer
- ☐ 8. Graphics Printer
- ☐ 9. High Speed Printer
- ☐ 10. Color Monitor
- ☐ 11. Monochrome Displays
- ☐ 12. Modems
- ☐ 13. Hard Disk
- ☐ 14. Tape Backup System
- ☐ 15. CPU Compatibility Card
- ☐ 16. Memory Board
- ☐ 17. Communications Port
- ☐ 18. Plotters/Charting Devices
- ☐ 19. Local Area Networks

Software Packages

- ☐ 21. Communications
- ☐ 22. Accounting
- ☐ 23. Order Entry/Inventory

- ☐ 24. Payroll

- ☐ 25. Time Billing
- ☐ 26. Financial Planners/Spreadsheet

- ☐ 27. Project Managers
- ☐ 28. Word Processors
- ☐ 29. Compilers
- ☐ 30. Database Managers
- ☐ 31. Program Developers/Generator Tools

Outside Services

- ☐ 32. Business Graphics
- ☐ 34. Maintenance
- ☐ 35. Education/Training
- ☐ 36. Software/Systems Design
- ☐ 37. Remote Computing
- ☐ 38. Database Services
- ☐ 39. Other

Expendables

- ☐ 41. Diskettes
- ☐ 42. Stock Paper
- ☐ 43. Forms & Other Consumables

11. Are there any other individuals at this location that would qualify for a complimentary subscription to PC WEEK?

Name \_\_\_\_\_ Title \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_

Your Signature \_\_\_\_\_

Your Title \_\_\_\_\_

Date \_\_\_\_\_

Please be sure to sign your name and list your actual title above.  
See other side for mailing instructions.



SEAL THIS SIDE ONLY—DO NOT USE STAPLES

FOLD HERE



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

# BUSINESS REPLY MAIL

FIRST CLASS

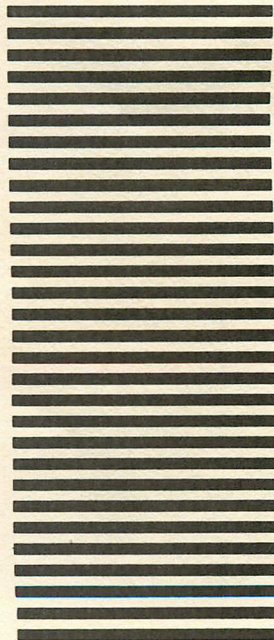
PERMIT NO. 3838

NEW YORK, NY

POSTAGE WILL BE PAID BY ADDRESSEE

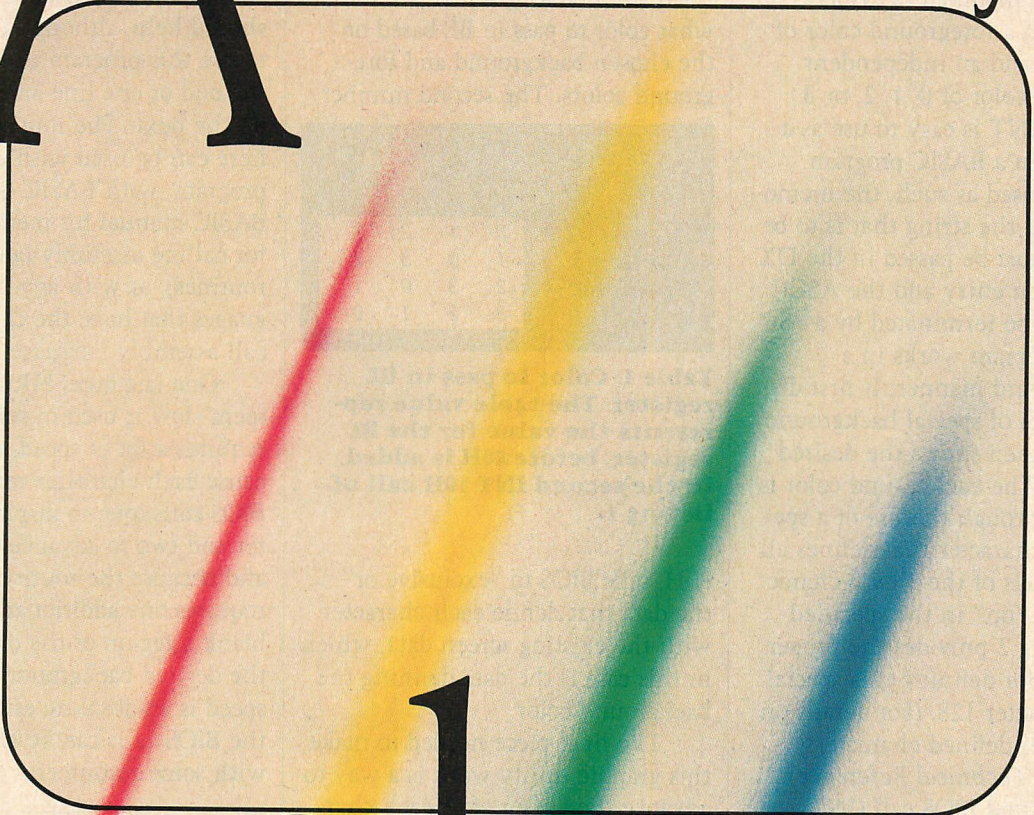
**10 WEEK**

P.O. Box 5920  
Cherry Hill, NJ 08034





# A screen of many colors



*A routine for greater choice of character color in color graphics mode*

MS-DOS and IBM BIOS provide routines to output a string of ASCII characters to a color display while in color graphics mode. MS-DOS provides function 9 (display a string until a termination character of "\$" is reached), and BIOS interrupt 10 (hex) provides a routine to write an ASCII character at a given cursor location.

Although these routines provide some elementary (and general) aids to the graphics programmer, they offer little flexibility. One particular problem with them is that they always destroy any background that is not color 0 when a character is displayed.

A simple assembly language program can add flexibility to these routines by allowing the user to write ASCII characters to a graphics display in any of the four colors on a selected palette; a background color of any one of four colors can also be preserved.



Normally, ASCII characters are displayed on a color screen (mode 1, 320 × 200 graphics) in a foreground color of 3 and a background color of 0. The "NR\_PRINT" routine in listing 1 can be modified to display characters in a foreground color of 0, 1, 2, or 3 and an independent background color of 0, 1, 2, or 3.

NR\_PRINT is easy to use as a subroutine in a BASIC program. When it is used as such, the memory address of the string that is to be displayed must be passed in the DX variable upon entry and the ASCII string must be terminated by a "\$."

The program works in a straightforward manner. It first displays a series of special background spaces and then shows the desired characters. The background color is generated through the use of a special ASCII character that defines all possible pixels of the 8 by 8 character block as "on" in the specified color. Listing 2 provides the proper subroutine for defining this special ASCII character 128. (For details on creating user-defined characters, refer to the *Technical Reference*).

The second BIOS call (INT 10H) displays each ASCII character in a special way. The BL register, which normally contains a number

that represents a color to use in displaying the character, now contains the sum of two numbers. The first number needed to form the value of BL is a color number (0 to 3) derived from table 1, which shows what color to pass in BL based on the chosen background and foreground colors. The second number,

		Desired background color			
		0	1	2	3
Color of displayed character	0	0	1	2	3
	1	1	0	3	2
	2	2	3	0	1
	3	3	2	1	0


**Table 1: Color to pass in BL register. The table value represents the value for the BL register, before 80H is added, in the second INT 10H call of listing 1.**

80H, tells BIOS to "exclusive or" the data that define each character with the existing screen data, which in this case is the data defining the background color.

The final piece needed to make this graphic utility work is a way to advance the cursor after each character is displayed, since the routine in listing 1 will display characters only at the current cursor location.

CURSOR\_SET, shown in listing 3, uses BIOS interrupt 10H to advance the cursor by 1.

Sometimes the capability to display characters in unusual color combinations is needed. NR\_PRINT should help, although it is difficult to use this program to display past the end of one line and then start on the next. The routines shown here can be used with an assembly program, with BASIC (see the BASIC manual for methods to use for calling assembly language subroutines), or with any other languages that have the capability to call assembly language subroutines.

One last note: NR\_PRINT will seem slow if used in software that requires a lot of speed; this is because each character requires three BIOS calls (one to display a character and two to advance the cursor) and because the routine NR\_PRINT requires one additional BIOS call to blank a region of the display with the desired background color. If speed is an absolute essential, all of the BIOS calls can be eliminated with some resourceful coding. 

*Don Awalt is systems engineering supervisor at EMC Controls. He is a former assistant professor who taught theory of operating systems at Loyola College.*

## Listing 1 NR\_PRINT.ASM

```
;
; ROUTINE TO PRINT ASCII DATA TO A COLOR MONITOR
; USER CAN DEFINE FOREGROUND AND BACKGROUND
; COLORS TO USE
; WRITTEN BY DON AWALT
; edit 12/83
;
DLR_SIGN EQU '$' ;terminating character for
;input string
SPCL_BLANK EQU 128
;
NR_PRINT PROC NEAR ;input in dx, term by '$'
    MOV DI,DX ;save in di for later use
    MOV SI,DX ;save here also
    MOV CX,0 ;will tell nr of characters
    ;to blank
GET_SIZE:
    MOV AL,[SI] ;first (or next) char of string
    SUB AL,DLR_SIGN ;compare with term character
    JZ BLANK_IT ;if equal, found the $
    INC CX ;count 1 more character
    INC SI ;advance to next in string
    JMP GET_SIZE ;go again
BLANK_IT:
    ;now to blank all positions
    ;at once
    MOV BH,0 ;page nr for bios call
    MOV AL,SPCL_BLANK ;defined in listing 2;
    ;ascii 128
```

```
MOV BL,1 ;color for background (1)
MOV AH,9 ;write character function
INT 10H ;video bios call
P_NEXT:
    CMP BYTE PTR [DI],DLR_SIGN ;done?
    JE PRINT_COMPLETE ;yes; we hit dollar sign
    MOV AL,[DI] ;now get character to display
    INC DI ;prepare for getting next char
    MOV BL,82H ;color 2 (with background 1
    ;gives color 3)
    MOV AH,9 ;write character function
    MOV BH,0 ;display page 0
    MOV CX,1 ;write 1 character
    INT 10H ;call bios (video)
    CALL CURSOR_SET ;listing 3; advance cursor
    JMP P_NEXT ;see if any more characters
PRINT_COMPLETE:
    RET ;done the work
NR_PRINT ENDP
```

## Listing 2 Subroutine for Defining Special Characters

```
;edit: rda 12/83
;
;this list defines an 8x8 character with
;all pixels turned "on." See BIOS listing
```



```
;in Tech Reference for other character definitions.
;
BLANK_DATA DB 0FFH,0FFH,0FFH,0FFH,0FFH,0FFH,0FFH,0FFH
;
INIT PROC NEAR
;this will set up an ASCII
;character 128
    LEA DX,BLANK_DATA ;all pixels on will be
                        ;ASCII 128
    MOV AL,1FH         ;address of our ascii chars
                        ;goes into vector 1fh
    MOV AH,25H         ;dos fcn call: set interrupt
                        ;vector
    INT 21H            ;dos fcn call
    RET                ;note that this must be done
                        ;before nr_print!
INIT ENDP
```

## Listing 3 CURSOR\_SET.ASM: Routine to Advance the Cursor

```
;edit rda 12/83
;
CURSOR_SET PROC NEAR ;advance cursor by 1
    MOV AH,3          ;bios read cursor position fcn
    MOV BH,0          ;display page 0
    INT 10H           ;dx has row,column of cursor
    INC DL            ;this increments column
    MOV AH,2          ;write cursor fcn call
    MOV BH,0          ;display page 0
    INT 10H           ;write cursor
    RET
CURSOR_SET ENDP
```

## HOW CAN YOU GET WHERE YOU'RE GOING IF YOU DON'T KNOW WHERE YOU'VE BEEN?

INTRODUCING...

# SOURCE manager

FROM SEVEN VALLEYS SOFTWARE

- CONTROLS & ORGANIZES THE MAINTENANCE OF YOUR FILES, SOURCE PROGRAMS, DOCUMENTS, ETC.
- KEEPS EACH UPDATE OR CHANGE AS A SEPARATE FILE
- ALLOWS RECREATION OF PAST VERSIONS
- WORKS WITH YOUR FAVORITE TEXT EDITOR (VEDIT, PERSONAL EDITOR, ETC.) TO CREATE UPDATE FILES AUTOMATICALLY

### PLUS...OTHER UTILITIES TO HELP MANAGE YOUR FILES:

- COMPRESS & EXPAND DISK FILES TO CONSERVE SPACE
- ENCRYPT FILES FOR LIMITED SECURITY
- DISPLAY DATA FILES IN BOTH HEX & ASCII FORMATS

**\$75**

**SOURCE  
manager**



(PA RESIDENTS ADD 6% SALES TAX.)

CALL OR WRITE FOR MORE INFORMATION:

**SEVEN VALLEYS SOFTWARE**



P.O. BOX 99  
GLEN ROCK, PA 17327  
(717) 235-5470

CIRCLE NO. 161 ON READER SERVICE CARD

## USING?...BUYING?...UPGRADING?...

### A GRAPHICS PACKAGE FOR YOUR PC

You have to create graphs and charts to tell a story. Your needs vary from financial statements and personnel benefits to inventory records. Presentations are made on slides, printouts and monitors. You need a good and easy-to-manage graphics package. You need **DESKTOP GRAPHICS FOR THE IBM PC: PRINTERS, PLOTTERS, CHARTS AND GRAPHS**, the fully illustrated guide to the preparation, design and production of business graphics.

This book is written with you in mind—the business or professional user with little technical or statistical knowledge, using or planning to purchase a graphics package. You'll find out what charts are available to you...what data works best with each chart...what hardware options you have... and a comparison of the four leading software packages that will best meet your needs.

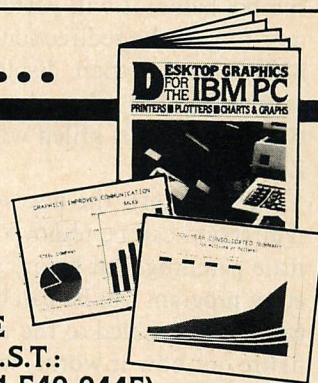
Author Corey Sandler gives you clear and non-technical introductions to graphics theory and statistics, making this seemingly impossible task, easy.

If you've been contemplating buying

a new graphics package or you just want to do more with your current package, this book is for you!

**For faster service, PHONE  
TOLL FREE: 9 am-5 pm E.S.T.:  
1-800-631-8112 (In NJ 201-540-0445).**

Also available at your local bookstore or computer store.



### CREATIVE COMPUTING PRESS

Department NN9H, 39 East Hanover Avenue, Morris Plains, NJ 07950

Please send me \_\_\_\_\_ copies of **DESKTOP GRAPHICS FOR THE IBM PC: PRINTERS, PLOTTERS, CHARTS AND GRAPHS** at \$14.95\* plus \$2.00 postage and handling (\$5.00 outside USA) each. Item #60-7.

Payment Enclosed \$\_\_\_\_\_. \* Residents of CA, NJ and NY State add applicable sales tax.

Charge My: ☐ AmEx ☐ MC ☐ Visa

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Mr./Mrs./Ms. \_\_\_\_\_ print full name

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

☐ Please send free catalog.



# MORE without Redirection

*SHOW.COM eliminates the input redirection symbol from MORE.COM.*

TECH  
NOTEBOOK  
25

MURRAY LESSER

The sample filter MORE.COM (distributed with the diskettes for PC DOS 2.x) could be a very handy substitute for the DOS command TYPE, because it allows a user with a fast hand on the Ctrl-NumLock key to keep the displayed ASCII file from scrolling off the screen. MORE suffers from one grievous fault, however: while it is useless without a target file to display, it requires the user to insert the redirection symbol before it will perform. If the user forgets the redirection symbol, MORE just sits there displaying everything that is keyed in—twice—until it is killed with a Ctrl-Z or Ctrl-Break.

Fortunately, the necessity for redirection can be removed with a little patching. But before a proprietary program can be patched, it has to be disassembled so the user can figure out how it works, what changes need to be made, and where they should go. All of this

can be done with DEBUG. Such disassembly of short proprietary programs is also a good way to learn some of the tricks of the trade in using the DOS facilities that are not explained clearly in the manual.

Disassembling MORE.COM showed that the code for “unredirecting” the standard input and storing the replicated “handle” for the target file in register BP is located in offsets 0128H through 0133H. MORE reads the target file (in four-kilobyte chunks) into memory starting at offset 021AH. The space in the original file between 021AH and the end-of-file at 027FH is filled with <NUL> [00] bytes.

Thus, the patch to delete the requirement for redirection begins with a JMP command at 0128H, jumps to new code at 0220H, and ends with a jump back to 0134H.

The procedure for patching MORE.COM (after copying it to SHOW.COM to avoid confusion) is

shown in figure 1. The keyed entries are in bold type. All numbers displayed or used by DEBUG are in hex. The segment values in the figure are for my system and probably will be different for other systems. C drive is a virtual disk that is part of resident DOS.

SHOW can be used as MORE was, except that the input redirection symbol can be omitted from the command line. If the user gives SHOW an input redirection symbol, it will respond as if a valid <file-spec> had been left off of the command line with the DOS prompt. If the redirection symbol and an invalid <filespec> are given, the command processor will return a “File not found” message before it shows its prompt.



*Murray Lesser is the author of Using Microsoft Compiled BASIC, published by McGraw-Hill in September. He retired after 26 years at IBM, where his last job was program manager, technical documentation.*

**Figure 1: Patching SHOW.COM with DEBUG**

C>DEBUG SHOW.COM		
-R		
AX=0000 BX=0000 CX=0180 DX=0000 SP=FFFE BP=0000 SI=0000 DI=0000		
DS=378B ES=378B SS=378B CS=378B IP=0100 NV UP DI PL NZ NA PO NC		
378B:0100 B430 MOV AH,30		
-A128	["Assemble" starting at offset 0128]	
378B:0128 JMP 220	[Jump to patch in offset 0220]	
378B:0128	[Exit "Assemble" mode with <Enter>]	
-A220	["Assemble" patch starting at 0220]	
378B:0220 XOR AH,AH	[Put count of number of bytes in	
378B:0222 MOV SI,80	[ "rest of command line"	
378B:0225 LODSB	[ into AX register]	
378B:0226 OR AL,AL	[Anything there?]	
378B:0228 JNZ 22C	[If so, continue]	
378B:022A INT 20	[Else terminate program]	
378B:022C MOV DI,81	[Set DI register to byte following	
378B:022F ADD DI,AX	[ "rest of command line".	
378B:0231 XOR AL,AL		[ turn off Carry Flag, and convert
378B:0233 STOSB		[ <filespec> to ASCII string]
378B:0234 MOV AH,3D		[Open <filespec> for reading,
378B:0236 MOV DX,82		[ returning "handle"
378B:0239 INT 21		[ in AX register]
378B:023B JC 22A		[Terminate if Carry Flag shows error]
378B:023D MOV BP,AX		[Move handle to location MORE expects
378B:023F JMP 134		[ and return to original code]
378B:0242		
-W		[Write patched SHOW.COM to file]
Writing 0180 bytes		
-Q		[Exit DEBUG]
C>		

Notes: Keyed input has been emphasized and comments in square brackets added.



# Beyond Board-Driven Networks

**Multi-User PC Networks.** Their ability to share expensive peripherals, programs, and files has always made sense. At least, in theory. The catch is that, previously, every workstation required its own PC . . . PLUS a kilobuck "Network Interface Board." In other words, your cost-per-user was over \$3,000. And that doesn't make sense. Not any more.

**The Multi-Tasking, Multi-User Network That's Software-Driven.** MultiLink™ represents a major breakthrough in networking systems. Network interface boards are not required. In addition, only one IBM PC/XT is needed in your network.

**Four Workstations for the Price of One.** MultiLink™ is a unique software package which transforms ONE IBM PC/XT (or PC-Compatible) into the CPU of a multi-tasking, multi-user network. It utilizes inexpensive terminals as workstations. Up to eight can be connected to a single PC with appropriate

serial ports. Currently, four of these terminals cost less than one PC.

MultiLink™ runs under all releases of PC-DOS (except 1.0) and certain implementations of MS-DOS. Leading programs such as WordStar, Lotus 1-2-3, PeachText 5000, and dBASE II are supported. In addition, most text-oriented software is fully-compatible.

**A Resource-Sharing System.** Multiple users are able to access all of your computer's resources, locally, or from remote locations using a terminal with a modem. Disk, printer, program-sharing, and a comprehensive print spooler are fully-implemented.

**Make the MultiLink™ Connection Today.** Call The Software Link TODAY, and get the whole story. MultiLink™ is immediately available for \$295 and comes with a money-back guarantee. VISA, MC, and AMEX accepted.

# MultiLink™



THE SOFTWARE LINK, INC.

8601 Dunwoody Place, Suite 336, Atlanta, GA 30338 Telex: 4996147 SWLINK

CALL: 404/998-0700

Dealer Inquiries Invited



MultiLink™ is a trademark of The Software Link, Inc.  
Terminals courtesy of QUME Corporation.

CIRCLE NO. 198 ON READER SERVICE CARD

IBM, PC, XT, & PC-DOS are trademarks of IBM Corp. MS-DOS, WordStar, dBASE II, Lotus 1-2-3, and PeachText 5000 are trademarks of Microsoft Corp., MicroPro, Ashton-Tate, Lotus Development Corp., & Peachtree Software, Inc. respectively.



# IF "C" IS YOUR LANGUAGE,

## LATTICE WINDOW™

*From Now On, All Your Applications Could Have Windows!*

**NEW RELEASE!**

**W**indows are no gimmick. Ask any user of a windowed product.

Windows can bring unrehearsed combinations of data side-by-side for viewing. Windows can overlay new information atop old, yet can restore the old with a keystroke. Windows let the limited space of a screen show many things, not just one thing.

Windows are one of the new software features people have come to expect. And why not? They make using software more convenient, more versatile. But how do you add this technique to your applications without disappearing for several months of R&D?

With Lattice Window, that's how. It's a product we've been waiting months for. One of those rare programming tools

which will change the way you think of program design. Here's how:

Lattice Window takes over all screen management. It is an extensive set of object code functions which you merely call from your C program.

Think of a window as a screen, a screen of flexible size. You can tell Lattice Window to open and close many such virtual screens. Up to 255 at a time, each from 1x1 to 255x255 bytes. Then tell "Window" to display any portion of these virtual screens on the physical screen — as many as fit. Tell "Window" to place them wherever you want, overlapping and overlaying at will.

Windows no longer needed may be closed. Any background area overlaid earlier (which could be corners of

several windows) will pop back to the screen. Think for a moment what a programming job that technique represents.

To your program, the entered window is the *entire* screen — all row and column references are relative to the window no matter its absolute position in the screen. All scrolling occurs only within the active window. The cursor will not leave its boundaries until your program says to. Any screen window may be entered for display, data entry, whatever. Any virtual screen — displayed or not — may be read from or written to by your program.

- You can move a window on the screen.
- You can grow it to display more of the underlying virtual screen. Or shrink it to show less.
- You can control screen attributes (color, blinking, inverse video, etc.) of any window.
- You can direct output to either the monochrome or color board.

It's a formidable product which will add incomparable flair to your next application!

Product Code: S0800  
Suggested Price: **\$295.00**

Our Price:  
**\$235.00**

## HALO

*A Spectacular Graphics Extension to Lattice C*

## PMATE

*The Programmer's Word Processor*

**P**mate was designed for programmers. We'll wager that you cannot find a programmer who has discovered Pmate and moved on to something else.

Pmate is a full screen editor with ten auxiliary buffers for squirreling away pieces of text until needed. It uses single key commands to move the cursor, or text, or insert or delete, or rescue several thousand characters of deleted text.

It has a format mode for tab setting or wraparound and shaping when it's time to write documentation. Pmate lets you assign chains of commands or strings of text to single keys: one keystroke could set up the entire shell of a new C function, for example.

Pmate has variables, if-then statements, loops. It calculates, and converts decimal to hex to binary and back. You can write compact programs (called "macros") to delete comments, for example, or check syntax, or process long sequences of commands. Macros can alphabetize lists, do row and column math, perform a series of operations on multiple files, even summon other macros.

Put another way, Pmate is a text editor with its own built-in interpretive language. A language you can use to completely customize this text editor to your fancy. Possibly the most artful, ingenious program you have ever seen.

Product Code: S0600  
Suggested Retail: **\$225.00**

Our Price:  
**\$175.00**

**H**alo™ will astound you. It provides a complete library of graphic functions which can be linked with your Lattice programs to create full-color charts, graphs, simulations, even animation.

Over 100 commands are at your disposal, including plot, line, arc, box, circle, plus single commands to produce bar graphs and pie charts. Pattern-fill and dithering commands give your graphics impressive texture and color mixes, rubber-banding draws shapes for interactive users, area moves produce animation, fill and flood commands paint areas. The newest version allows you to define your own world coordinate scheme, divide the screen into "viewports" (windows), and scale graphic figures automatically.

It's a long list of capabilities which make for an extraordinarily powerful product. In fact, Halo is so good that manufacturers of graphics boards and systems are adopting it as a standard graphics language. So it can bridge your application to other systems. CAD-CAM developers, especially, have embraced its device-independent approach for maximal portability.

Halo is a dazzling demonstration of why C has become the language of choice among programming professionals: its function library architecture means you can tremendously enhance your firepower by acquiring libraries of software like Halo with dramatic economy of time and money.

Requires IBM monochrome or color graphics card or equivalents.

Product Code: S0300  
Suggested Price: **\$200.00**

Our Price:  
**\$125.00**

## PLINK86

*Overlay Linkage to Expand*

**S**oftware is becoming ever more sophisticated, which means more complex programs requiring large chunks of memory. But if you use extra memory, if you count on users to have expanded RAM, you will forego sales to those who do not.

Plink86 is the answer. It takes on the job of shoe-horning large programs into small memory. First, Plink86 acts as an alternative to DOS' Link. For a language like C which encourages design of separately compiled object modules in the Microsoft relocatable format, Plink86 pulls modules together into single compiled programs. But Plink86's overlay power is what has gained it a reputation as a miracle worker. It binds into the compiled program its overlay manager which knows how to swap modules of your large linked program between disk and memory, so that each can temporarily occupy the same memory space.

Unlike other linkers, the overlay manager acts on its own, needing no calls from the source program. Instead, Plink86's straightforward overlay description language allows you to describe your overlay structure in one place in your program — a structure



# PC BRAND HAS THE TOOLS

## Your Productivity Could Take Off With Our Craftsman™ Line of Precision Tools

### C-FOOD SMORGASBORD

#### A Menu of Difficult to Prepare C Functions

**C** is a language of function libraries: sturdy routines which your application can effortlessly reference to get the job done. But someone has to write them. It would take months to concoct and perfect the complex and useful servings which have been prepared for you and thoroughly tested in C Food Smorgasbord™.

**Decimal Arithmetic:** Functions to perform operations on binary-coded decimal (BCD) numbers of up to sixteen significant digits. Includes trigonometric and logarithmic functions, powers, conversions to strings, and much more.

**Level 0 I/O Functions:** Enable you to perform direct I/O operations for screen, keyboard, printer, and asynchronous port with no dependence on higher I/O functions to minimize memory usage and maximize speed.

**IBM™ PC BIOS Interface Access:** Allows you to get at the basic I/O services in the ROM BIOS not available through the normal operating system to get and set the video mode, cursor position, color and screen attributes,

keyboard shift, scrolling, printer channel and port status.

**TIP, the terminal independence package:** Lets you easily move programs to computers with different types of terminals.

There is a basket of delicacies beyond this brief list; a cornucopia to sample, any one of which will save valuable time and pay back far more than C-Food Smorgasbord's overall price.

Product Code: S0200  
Suggested Price: **\$150.00**

Our Price:  
**\$115.00**

All products operate on the IBM PC or PC/XT under PC-DOS and require no more than 64K of RAM unless indicated.

Prices, terms and specifications subject to change without notice.

Prices do not include shipping and handling.

You may freely use these products to create software applications for re-sale without additional licenses or royalty payments, provided your applications are not wholly or substantially replications of the products themselves.

Unix TM Bell Laboratories / Lattice C, C-Food Smorgasbord, and Lattice Window TM Lattice Inc. / MS TM Microsoft Inc. / Halo TM Media Cybernetics / IBM TM International Business Machines / Float87 TM Microfloat / Panel TM Roundhill Computer Systems Ltd. / Plink86 and Pmate TM Phoenix Software / CP/M-86 TM Digital Research

### PANEL

#### Are You Still Coding Hand-Made Data Entry Screens?

**D**esigning custom screens is intricate, time-consuming, and costly. It can make you the loser in competitive bidding. It can add weeks, even months to bringing your product to market.

But not when you use Panel™. Put Panel to work and you hire a superprogrammer for the minimum wage. Telling Panel your screen design is like using a word processor. You can add, move, copy, delete, and reshape fields with single key commands. The result? Finished C program code with field descriptors, color and highlighting, input editing by type of field, help keys, and warning messages.

Panel can also create a terminal selection program customized for your application, and gives you a utility to quickly test your finished screens. It even includes a multi-key data file maintenance program which interacts with the screen you design. All the tools you need to generate code for the trickier aspects of your application, or even to create stand alone data entry and retrieval products without any programming.

Panel routines are powerful. Unlike so many programs which make error correction difficult once a field is departed, Panel gives the user full field-

to-field movement for editing, and overtype or insert/delete within fields.

A truly superior productivity tool every developer should have.

Product Code: S0400  
Suggested Price: **\$295.00**

Our Price:  
**\$235.00**

### FLOAT-87

#### Software Support for the 8087 Math Chip

**F**loat-87™ is a library of floating-point math routines which are merged into a Lattice C interface library. The routines handle all arithmetic functions and the most frequently used transcendental or trigonometric functions, and pass all numbers to the 8087 to take advantage of its 80-bit data format.

Putting Float-87 to work with an 8087 can increase the speed of floating-point calculations by 40 times or more — and with greatly expanded accuracy. If you or your customers have an Intel 8087 math processor chip on board, this software will switch on its afterburners.

Product Code: S0700  
Suggested Retail: **\$125.00**

Our Price:  
**\$100.00**

### Your Art of the Possible

permitting up to 4,095 overlays stacked 32 deep. And you don't have to re-compile to re-arrange the structure.

**Plink86** is a two pass linkage editor. On the first reading it determines all modules which need loading, to insure greater flexibility in assigning memory segment addresses before the disk file is created on the second pass. It can even sub-divide its linked output into multiple files for programs which must span more than one disk.

But most of all it sets you free to write the comprehensive code today's users have come to expect without sacrifices to memory constraints.

Product Code: S0500  
Suggested Price: **\$395.00**

Our Price:  
**\$315.00**

You won't find an offer like this elsewhere: Exceptional prices and software fully supported by a knowledgeable staff specializing in 'C' and companion tools.

# 1-800-PC BRAND

That's 1-(800) 722-7263. In NY State call (212) 410-4001.

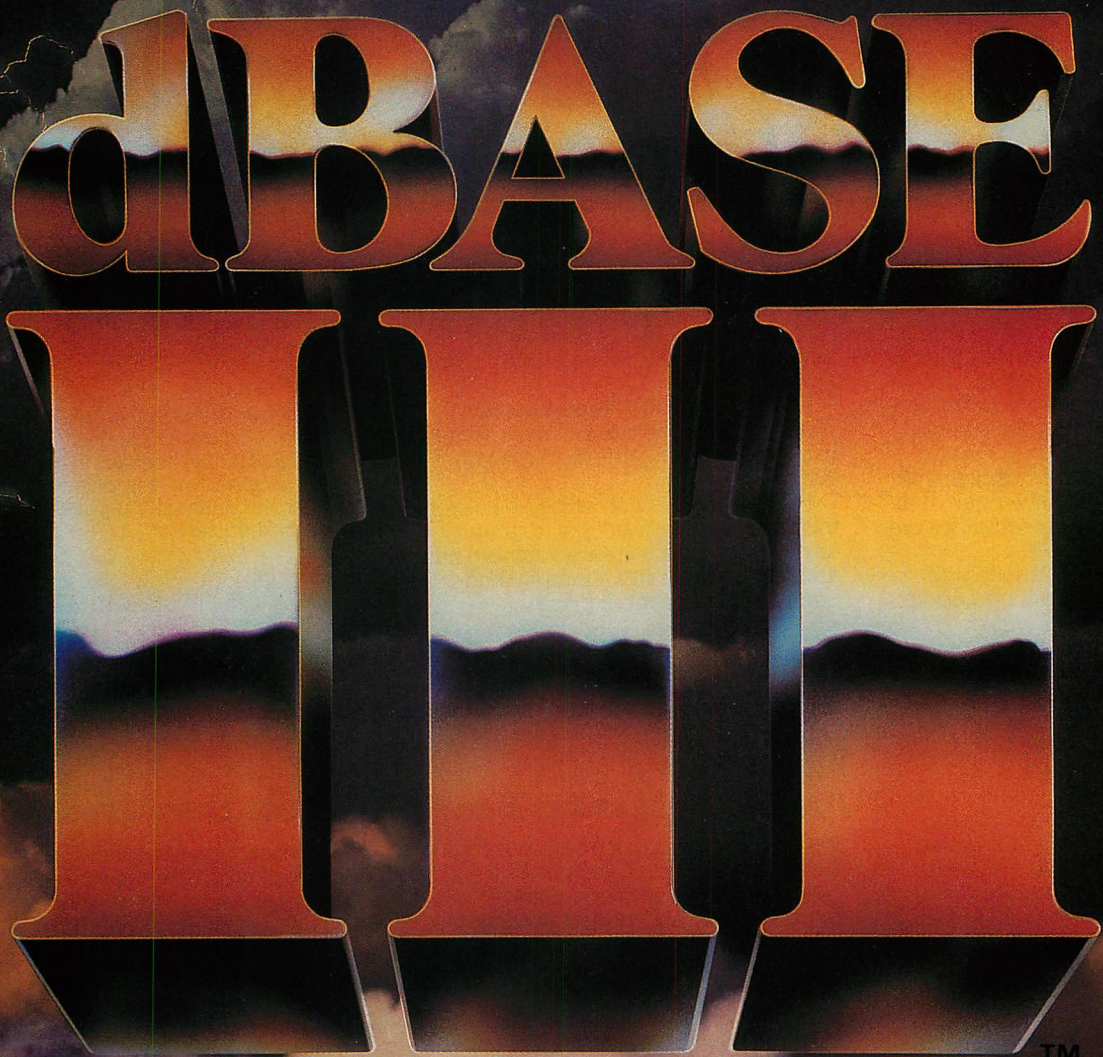
Charge your purchase to MasterCard or Visa.

Or mail your order and check to

PC Brand, P.O. Box 474, New York, N.Y. 10028



# dBASE III



TM





# More power to you.

Remember the magic you expected when you first purchased a PC?

It's here.

dBASE III™ is the most powerful database management system ever created for 16-bit microcomputers. It pulls every ounce of energy out of your PC and puts it to work.

On top of that, it's fast and it's easy.

**You've never seen anything like it.**

dBASE III can handle over a billion records per file, limited only by your computer system. You can have up to ten files open, for sophisticated applications programs.

When you have two related files, information in one can be accessed based upon data in the other.

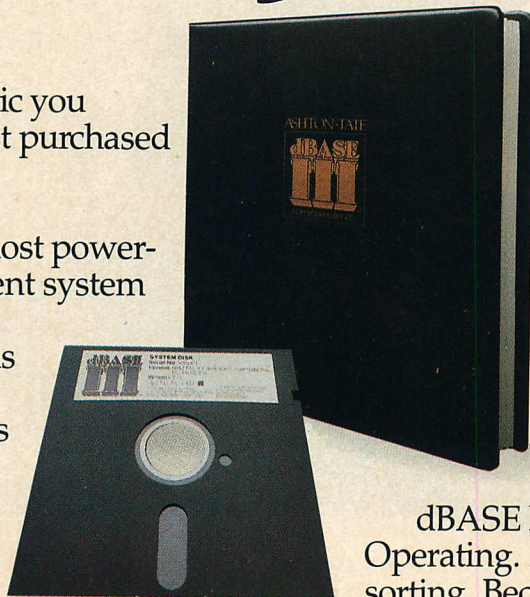
dBASE III now handles procedures, parameter passing and automatic variables. You can include up to 32 procedures in a single file. With lightning speed. Because once a file is opened, it stays open. And procedures are accessed directly.

**Easier than ever.**

dBASE III uses powerful yet simple commands that are the next best thing to speaking English.

If you're unsure of a command, HELP will tell you what to ask for.

If you don't know what command comes next, a command assistant does. All



you have to know is what you want it to do.

Our new tutorial/manual will have you entering and viewing data in minutes rather than reading for hours.

And to make matters easier, you get a full screen report setup for simple information access.

**Faster than no time at all.**

dBASE III isn't just fast. It's ultra-fast. Operating. And sorting. Even faster, is no sorting. Because dBASE III keeps your records in order, so you really don't have to sort anything. Unless you want to. Then watch out!

**What about dBASE II®?**

It's still the world's best database management system for 8-bit computers. And it's still the industry standard for accounting, educational, scientific, financial, business and personal applications.

**Tap into our power.**

For the name of your nearest authorized dBASE III dealer, contact Ashton-Tate, 10150 West Jefferson Boulevard, Culver City, CA 90230. (800) 437-4329, ext. 333. In Colorado, (303) 799-4900.

CIRCLE NO. 300 ON READER SERVICE CARD

## ASHTON-TATE

© Ashton-Tate 1984. All rights reserved. dBASE III and Ashton-Tate are trademarks and dBASE II is a registered trademark of Ashton-Tate.



# October, November & December are



# PC Tech Journal Program Listings on Diskette.

**T**HAT'S RIGHT! You don't have to type in detailed program listings from this October issue. You can order them on a LISTING DISKETTE™ from PC Tech Journal. And on the same diskette you'll also receive the program listings for the upcoming November and December issues.

Certain listings require use of other material (e.g. Pascal compiler). Please consult relevant article in magazine.

For your added convenience, we also offer two other LISTING DISKETTES from previous issues. They're all listed in the coupon. To order, simply fill it out. Charge-card customers can also use our toll-free telephone numbers. (Sorry, no C.O.D. or "bill me" orders.)

**CALL TOLL-FREE 1-800-526-0790**

New Jersey residents: (201-540-0445)

## OR MAIL COUPON BELOW

# TECH JOURNAL

**PC TECH JOURNAL**  
Listing Diskette Service  
39 East Hanover Avenue  
Morris Plains, NJ 07950

Please send me the following Listing Diskettes:

- ☐ No. 6—Oct., Nov. & Dec. '84 issues . . . \$19.95  
☐ No. 5—Aug. & Sept. '84 issues . . . . . \$19.95  
☐ No. 4—June & July '84 issues . . . . . \$19.95

Total \$ \_\_\_\_\_

- ☐ Check Enclosed      ☐ Please charge my credit card:  
☐ MasterCard      ☐ Visa      ☐ American Express

No. \_\_\_\_\_ Expiration Date \_\_\_\_\_

Signature \_\_\_\_\_

Name \_\_\_\_\_

Company\_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Please allow approximately four to six weeks for delivery.



# INSIDE

# 1-2-3

## WORKSHEET FILES

---

WILLIAM F. SHARPE

---

*It's possible to create a program that takes advantage of 1-2-3's good points while lessening its shortcomings*

Since it appeared on the market Lotus 1-2-3 has maintained its position on the best-seller lists of programs sold for the IBM Personal Computer—and apparently for good reason. Seasoned PC operators seem

able to do almost anything with it. Nothing is perfect, however.

For some tasks 1-2-3 requires substantial effort and has an excessive “run time.” It is difficult (but not impossible) to do multiple regression, quadratic programming, and matrix inversion with 1-2-3, although these tasks are more easily performed with other programs.

Even for such procedures, however, 1-2-3 is ideal for preparing input, transforming variables in various ways, and providing graphs of output. Its good points can be used

to advantage and its drawbacks alleviated if 1-2-3 is used for preparation of input for a “foreign” program and for analysis of its output.

A typical procedure involves five steps:

1. Prepare input using 1-2-3, saving the input as a 1-2-3 worksheet file.
2. Use the Lotus Translate facility

---

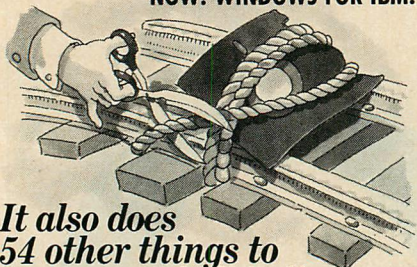
*William F. Sharpe is Timken Professor of Finance at the Stanford University Graduate School of Business. He currently is preparing a series of programs under the trademarked name “Worksheet Tools.”*

---



# Of course, POWER!™ saves your Bad Disk.

NOW! WINDOWS FOR IBM!



*It also does  
54 other things to  
keep your disk in line.*

## EVERYTHING YOU ALWAYS WANTED TO DO, BUT WERE AFRAID TO TRY

Unlike some utility programs that are a headache to use, POWER! is engineered to spoil you with 55 features, simple and uniform commands, and utter simplicity of use. POWER! automatically alphabetizes and numbers your files. You select by the number and never type file names again. Need to [COPY], [RENAME], [ERASE], or [RUN] programs? Just type in their menu number! POWER! also locks out your disk's bad sectors [TEST] without destroying files—a critical difference from other utilities that search and destroy, without informing you what they've done, leaving you to wonder why your programs won't run. (And POWER! still has 50 commands to go!)

## POWER! ONE PROGRAM DOES IT ALL!

You may own a few utility programs for your computer housekeeping, each with its own commands to memorize. POWER! has all the programs rolled into one 16K integrated package, so you do things you've never tried before—every day. Save sensitive data from prying eyes with [PASS] word protect, move a block of memory [MOVE], look for data [SEARCH] or compare files [CHECK]. POWER! also makes easy work of patching, [DISPLAY/SUBSTITUTE], customizing software [LOAD/SAVE]. Among the other commands are [SIZE], [STAT] [LOG], [DUMP], [TYPE], [JUMP], [FILL], [SET], and the CP/M version lets you restore erased files—even when you don't remember the filename—at a flick of the POWER! [RECLAIM] command. (Still 31 commands to go!)

## POWER! NOW FOR IBM's PC-DOS AS WELL AS CP/M

We first developed POWER! for CP/M two years ago, and a stack of testimonials from FORD to XEROX testify to its excellence. For IBM-PC™ users, special features like managing sub-directories, [CHANGE], and a separate creation of up to 8 simultaneous, on-screen [WINDOWS] have been added.

## MONEY-BACK GUARANTEE AND A 10 DAY TRIAL

POWER! has the Seal of Approval from the Professional Software Programmers Association, and you, too, must be happy with POWER!—or your money back! For only \$169 you can now really be in control of your computer. Call Computing! at (415) 567-1634, or your local dealer. For IBM-PC or any CP/M machine. Please specify disk format.

*The company that earns its exclamation point.*

# COMPUTING!

2519 Greenwich, San Francisco, CA 94123

**TO ORDER CALL 800 TOLLFREE  
800-428-7825 Extension 96G  
In CA: 800-428-7824 Extension 96G**

IBM and IBM-PC are registered trademarks of  
International Business Machines Corporation.

## WORKSHEET FILES

to convert the 1-2-3 worksheet file to a DIF file.

3. Run the foreign program, which takes its input from the DIF input file and sends its output to another DIF file.
4. Use the Lotus Translate facility to convert the DIF output file to a 1-2-3 worksheet file.
5. Load the output worksheet file into 1-2-3 for further analysis, plotting, etc.

This is not simple. Moreover, since most of the information is numeric, a great deal of translation is involved. Lotus 1-2-3 stores numeric data in binary format. In the DIF format, numbers are stored as ASCII characters. Thus step two translates binary numbers to ASCII character strings. The foreign program must retranslate the character strings to binary numbers, do its work, then translate its numeric output to character strings to be written in the DIF format. Step four involves further translation—from character strings to binary numbers. For large problems, such translation can require minutes of processing.

Happily, there is a better way. An analytic program can read input directly from a 1-2-3 worksheet file and prepare another 1-2-3 worksheet file containing output. This obviates steps two and four, speeds up the process, and allows more information to be transferred between 1-2-3 and the "foreign" program.

To write such programs, of course, it is necessary to understand the format of 1-2-3 worksheet files. Lotus does not currently provide this information, but it can be deduced by examining enough examples of files created with 1-2-3.

The following information is believed to be accurate for Version 1A of Lotus 1-2-3 for the IBM Personal Computer. Other implementations may differ substantially. A Microsoft (IBM) BASIC program for reading and printing information from a file will be used for illustration. BASIC is a particularly inap-

propriate language for this task, but it is familiar and widely available. A more efficient (but more complex) BASIC program could be prepared. Better yet, a more appropriate language (for example, Pascal or C) could be selected.

## THE RECORD STRUCTURE

Worksheet files are composed of a series of records of variable lengths. Each record begins with a header, consisting of a pair of two-byte inte-

---

**F**or some tasks 1-2-3  
requires substantial  
effort and has an ex-  
cessive "run time."

---

gers that indicates the record type and length. The record length indicates the number of bytes in the remainder of the record. Figure 1 shows the general structure of a worksheet record.

There are many types of records. For reading and writing files of data, the following suffice:

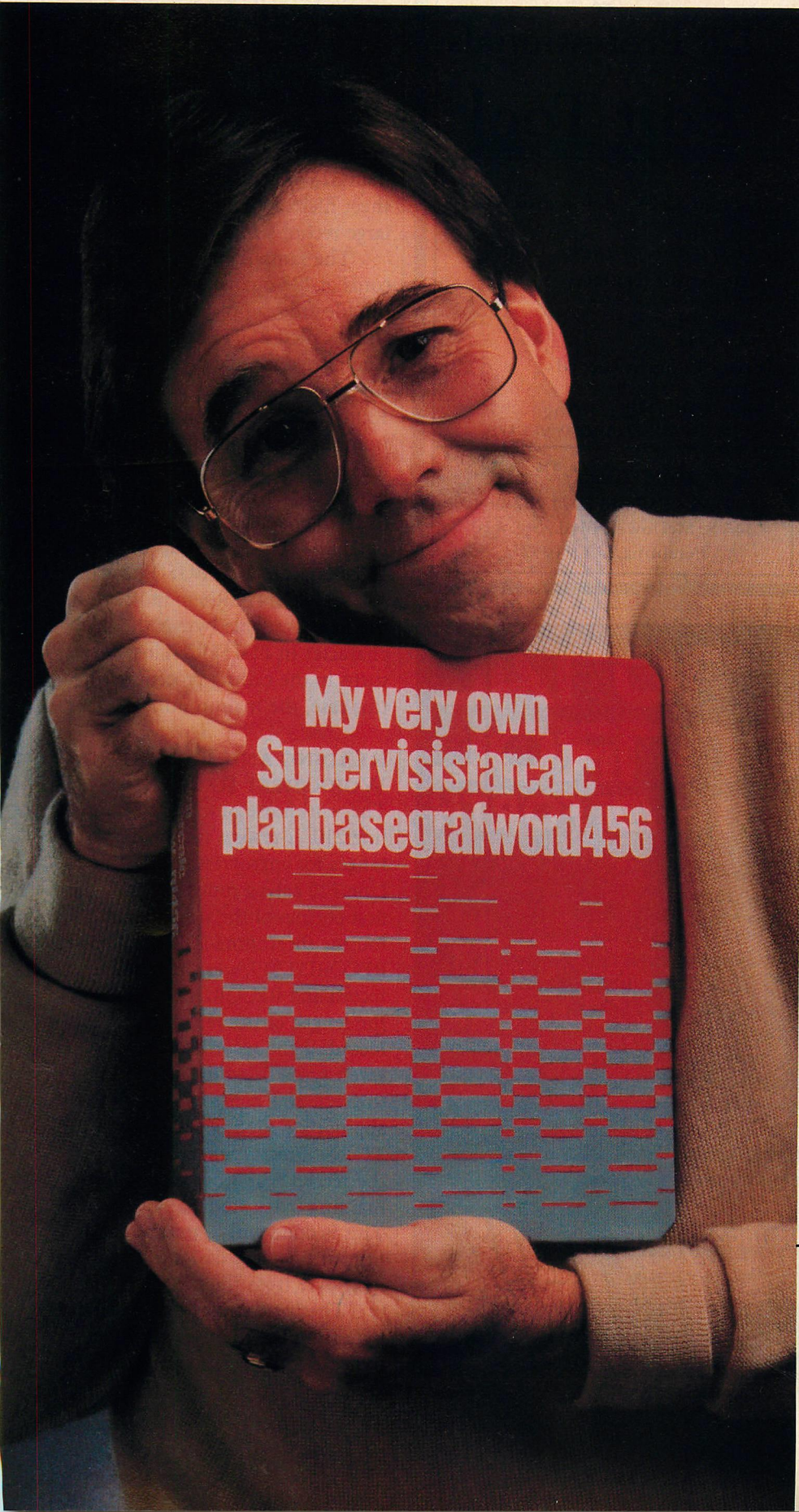
- Record type 0 : Header
- Record type 6 : Range
- Record type 13: Integer value
- Record type 14: Double-precision value
- Record type 15: Character string (Label)
- Record type 16: Formula and current value
- Record type 1 : End-of-worksheet

Examples of each of these types of records are provided in figure 2. Listing 1 gives the BASIC program to read and print the contents of a worksheet file.

To process a worksheet involves: opening the file and checking for a valid header; reading and processing records; and stopping when the end-of-worksheet record has been read. Lines 40 through 100 of the program provide a "main routine" to do this. Two routines are called—one (line 120) to open the



# Do it yourself!



When developing effective applications for the PC is a matter you want to take into your own hands, first get your hands on the APL★PLUS®/PC System from STSC. This unique application development tool gives you the power to deliver totally integrated, highly efficient solutions to problems that conventional software simply can't handle.

The APL★PLUS/PC System is the most advanced application development system available today. And it includes enhancements for the professional, hobbyist, or novice programmer.

—Advanced *screen management facility* with windowing and scrolling features.

—Complete *on-line HELP facility* for novice users.

—Powerful *communication capability* for moving data between computers.

—Comprehensive *color graphics capability, and much more.*

Because of the efficiency of the APL★PLUS/PC System, you can develop programs 4 to 10 times faster than with conventional languages like BASIC or FORTRAN. And the system can be integrated with other applications you've already bought, or used to link those that aren't speaking to each other. It doesn't demand that you abandon those skills you've learned or the software you've come to love. But it does enhance your programming power, so you can do what you do even better!

Get the advanced capabilities of the APL★PLUS/PC System for only \$595.00, a valuable investment when you can have things done your own special way. To order the APL★PLUS/PC System see your local dealer or contact STSC, Inc., (800) 592-0050, 2115 East Jefferson Street, Rockville, Maryland 20852.

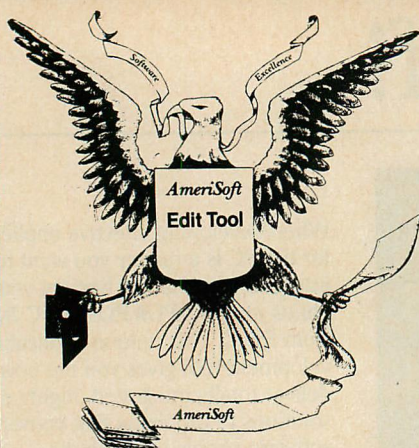
CIRCLE NO. 208 ON READER SERVICE CARD

**STSC**  
A Contel Company

The APL★PLUS/PC System runs on the IBM PC with 192 KB of RAM, as well as on a number of compatible machines.

APL★PLUS is a service mark and trademark of STSC, Inc., registered in the United States Patent and Trademark Office and in certain other countries.





# EDITOR for Programmers & DP Professionals **Edit Tool**

List \$225, demo disk \$10

## *micro flexibility . . .*

**Multi-Window/File**  
full screen editing, up to 20 files

**Move/Copy/Delete**  
one or more marked blocks

**Directory w/Free Space**  
also read, write, rename, erase files

**Build New Commands**  
with key macros

**Power Down Recovery**  
and optional auto-backup

**Restore Deleted Text**  
plus view 10 scratch buffers

## *mainframe power . . .*

**Search and Replace**  
with repeat and wildcards

**Large Files**  
edit over 1 megabyte

**Fixed Length Records**  
as long as 60,000 bytes

**Hex/EBCDIC Editing**

CIRCLE NO. 166 ON READER SERVICE CARD

**AmeriSoft** <sup>TM</sup>

(707) 778-8594 • (707) 762-0640

345 S. McDowell Blvd., Ste. 410

Petaluma, CA 94952

## WORKSHEET FILES

file, and another (line 210) to read and process a record.

Worksheet files may contain anything—including a Control-Z (ASCII 26) character. Since this signals the end of a standard text file, "random" file access must be used, even for serial processing. In BASIC, random files may have no more than 32,767 records. Since worksheet files can be long, a relatively large record size is necessary.

The sample program uses records of 128 characters. Portions of the file are read into a character string called BUFFER\$, as needed. The procedure to do this extends from lines 120 through 190. Lines 130-160 receive the name of the file from the user, append .WKS, open it as a random file with a record length of 128, and assign all input to a 128-character string named BUFFER\$. Line 170 reads the first 128 characters into BUFFER\$. Line 180 sets POINTER% to indicate that the next available byte is the first character in BUFFER\$. Line 190 returns to the calling procedure (in this case, the main routine).

## READING AND PROCESSING WORKSHEET RECORDS

The workhorse procedure begins at line 210. It reads a record and arranges for appropriate processing. Line 220 calls a routine to read the first portion of the next record. This routine (beginning at line 370) sets RECORDTYPE% to the type of record and RECORDLENGTH% to the length of the remainder of the record. If the record is one of the seven types listed in lines 240 through 300, control is passed to the appropriate routine (which will RETURN directly when through). If the record is another type, the remaining bytes are read but ignored. This is done with a routine (beginning at line 480) designed to get the next byte from the file.

The basic strategy for getting a byte from the file uses a pointer, indicating the position in BUFFER\$



**PC FORTH** <sup>TM</sup>

**IBM PC & XT,  
HP-150,  
Macintosh,  
Apple II,  
CompuPro,  
Sage & CP/M-68K,  
Wang PC,  
All CP/M and  
MSDOS computers.**

Try the *professional language* offering the *utmost performance* in the *shortest development time*. Transport your applications between any of our enhanced 83-Standard compilers or expanded 32-bit versions. Choose from our wide selection of programming tools including native code compilers, cross-compilers, math coprocessor support, and B-Tree file managers. All fully supported with hotline, updates, and newsletters.

**Laboratory Microsystems Incorporated**

Post Office Box 10430, Marina del Rey, CA 90295

Phone credit card orders to (213) 306-7412



CIRCLE NO. 159 ON READER SERVICE CARD



# The right network isn't a matter of choice. It's a matter of fact.

**Fact: You can't buy smarter than an OMNINET™ Network.**

Whether you have 2 microcomputers or 200, you bought them to handle information. If each micro has to handle it separately, both your equipment and your people are working inefficiently.

Because they could network with OMNINET. Sharing information — as well as the printing and data storage equipment that really puts information to work.

Add CORVUS' SNA Gateway, and you can link your entire network directly to your mainframe.

That's why an OMNINET Network uses simple, telephone-type line. Even relocating the system to a whole new building is just a move. Instead of a construction project.

**Fact: OMNINET Networks offer unmatched compatibility.**

From Apples to Zeniths, OMNINET handles more varieties of computers than any other network.

So keep the DEC's in Data Processing and the PC's in Purchasing. OMNINET will keep them all on speaking terms.

**Fact: The experts network with OMNINET.**

Over 30 of the major computer companies have licensed OMNINET for networking their micros. So you don't have to worry about support tomorrow for the system you pick today.

And OMNINET already has the most software options around — over 500 programs to choose from, according to your people's needs. Not their network's limitations.

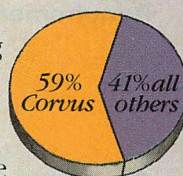
**Fact: The facts have made us #1.**

CORVUS pioneered local area networking for microcomputers, and we've never stopped working on ways to improve it.

Just give us a ring at **800-4-CORVUS** to find out more.

Because while calling ourselves the best is a matter of opinion, telling you that 3 out of every 5 locally networked micros work on a CORVUS network is something else.\*

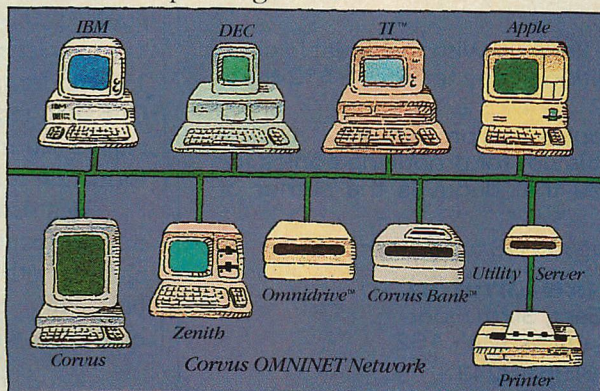
It's a matter of fact.



**Fact: This network was designed for microcomputers.**

Micros get moved. Businesses expand.

Your network should be able to grow and change just as fast as your business does.



**CORVUS**  
The Networking Company.

\*59% of all locally-networked micros operate in a CORVUS network, according to InfoCorp. CORVUS, THE NETWORKING COMPANY, OMNINET, OMNIDRIVE and CORVUS BANK are trademarks of CORVUS SYSTEMS, INC. IBM PC is a trademark of International Business Machines. APPLE is a trademark of APPLE COMPUTER INC. DEC is a trademark of DIGITAL EQUIPMENT CORPORATION. Zenith is a trademark of Zenith Corporation.

CIRCLE NO. 221 ON READER SERVICE CARD



## GET "C" APPLICATIONS OFF TO A FLYING START WITH

### C-TREE™

#### RECORD MANAGEMENT SUBSYSTEM

- Advanced B+ Tree Structure
- Very Fast And Efficient
- Unlimited # Of Keys
- Keys May Be Duplicate, LIFO/  
FIFO, Modifiable
- Record Locking Calls
- Random And Sequential Access
- Utilities To Add/Delete Keys And  
Fields, Rebuild Files
- Error Processing Interface
- Store Data Dictionary In File

### C-SORT™

#### SORT/SELECT/MERGE SUBSYSTEM

- Advanced Quick/Tournament  
Combination Sort
- Sort C-Tree Or Sequential Files
- Automatically Uses All Available  
Memory, And Merges On Disk
- Sorts On Up To 50 Fields Or  
Partial Fields; Unlimited  
Number Of Selection Criteria
- Creates Tag (Index) Sorting File,  
Leaves Original File Intact

#### ordering information

##### SINGLE UNIT OBJECT LICENSE

\$99 per program plus shipping.  
Format 5¼ Disk MS-DOS  
Compatible Linkable 8086-file  
format modules for Lattice-C or  
Microsoft-C Compilers, others  
soon. Complete documentation.

##### SOURCE CODE LICENSE

\$249 per program plus shipping  
(single unit). "C" Source Code is  
well documented. Allows modification  
to suit application. Credit allowed  
for object license.

##### MULTIPLE COPY LICENSE

Multiple copies of object code  
or source code derivatives may  
be made with this license at  
a very low unit cost.

**AccuData Software™**

Dept. T-9

P.O. Box 6502

Austin, Texas 78762

Telephone Orders Accepted

Visa/Mastercard

(512) 476-8356

CIRCLE NO. 157 ON READER SERVICE CARD

# CopyWrite backs up IBM PC Software.

We have not found anything yet we can't copy. Copy-protected software is copied readily. **CopyWrite** needs no complicated parameters.

**Requirements:** IBM Personal Computer or XT, or Columbia, or Corona.  
64k bytes of memory.  
one diskette drive.

**CopyWrite** will run faster with more memory or another drive.

**CopyWrite** is revised monthly, to keep up with the latest in copy protection. You may get a new edition at any time for a \$12 trade in fee.

**CopyWrite** makes back up copies to protect you against accidental loss of your software. It is not for producing copies for sale or trade, or for any other use that deprives the author of payment for his work.

**CopyWrite** is available at a price of \$50 US funds from:

**Quaid Software Limited**

45 Charles Street East, Sixth Floor  
Toronto, Ontario, Canada M4Y 1S2

Telephone (416) 961-8243

CIRCLE NO. 194 ON READER SERVICE CARD

## WORKSHEET FILES

in which the desired byte is stored. This is incremented by one after each byte is used. If the resulting value exceeds 128, the next 128 characters are read into BUFFER\$, and the pointer is reset to 1.

Lines 480 through 550 do the work. The next byte is copied into BYTE\$ as a character and the pointer is incremented so that it indicates the next character in BUFFER\$. If necessary, a new set of bytes is read into BUFFER\$ and POINTER% is reset. Line 490 saves the previous byte for possible further processing.

As indicated earlier, each record starts with a header—two bytes indicating the type of record, followed by two bytes indicating the length of the remainder of the record. These values are to be stored in two variables: RECORDTYPE% and RECORDLENGTH%. The requisite procedure begins at line 370. In each case, two bytes are obtained (using the procedure at line 480). They are combined to form a string (called PREVIOUSBYTES\$ + BYTE\$) that then is converted to an integer value by the CVI function.

Processing the header (type 0) record is not strictly necessary. However, checking its validity is wise. It also should be the first record on the file. A valid header record has a length of two bytes. Version 1A of Lotus 1-2-3 writes an ASCII 4 in each one. All three conditions are checked in the procedure that runs from line 1010 to 1100.

### DATA RECORDS

Data are stored in four types of records: integer value records (type 13), double-precision value records (type 14), character string records (type 15), and formula records (type 16). One such record exists for each occupied cell in the worksheet. No information is stored for empty cells.

Each data record includes information about location of the cell, including both row and column numbers. These row and column numbers begin with zero; thus, row



# MATCH WITS WITH YOUR ACCOUNTANT, TEACHER ...OR ALIEN WARRIORS

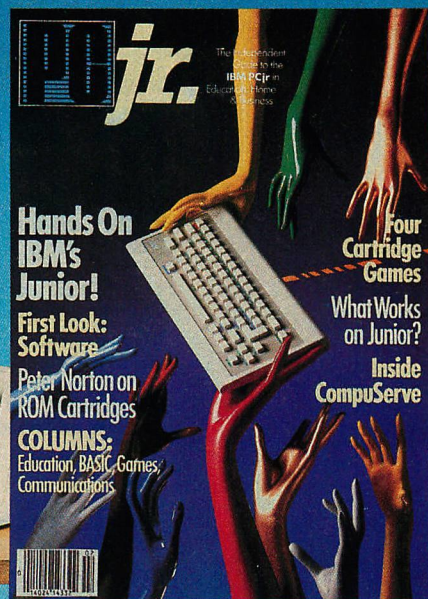
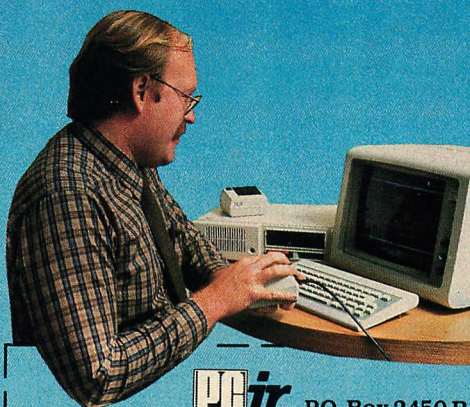
Balancing your monthly statements or the fate of the universe can be equally harrowing experiences.

MASTER THESE CHALLENGES WITH PCjr., The Independent Guide To The IBM PCjr in Education, Home and Business. PCjr. will help you fight off marauding invaders from other worlds AND help you maximize the performance of your PCjr with new business, education and finance applications!

Written in plain english, PCjr. is the guide you need to help you add-on new peripherals and modems...to keep abreast of the newest releases in software and hardware...to make your PCjr a formidable business, educational and recreational computer!

Subscribe to PCjr. and save! Save your finances! Save your grade point average! Save the universe!

**SAVE UP TO 44% WITH PCjr.!**



**PCjr.**

P.O. Box 2450 Boulder, Colorado 80322

**YES, please enter my subscription to PCjr. for:**

☐ 8 issues  
for \$9.97.

I SAVE 40%!

☐ One year  
for \$14.97.

I SAVE 40%!

☐ Two years  
for \$27.97.

I SAVE 44%!

Savings based on full one-year subscription price of \$24.97.

Mr./Mrs./Ms. \_\_\_\_\_

Please print name in full

82011

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip \_\_\_\_\_

Check one: ☐ Payment enclosed ☐ Bill me later

Charge my: ☐ American Express ☐ Visa ☐ MasterCard

Card No. \_\_\_\_\_

Exp. Date \_\_\_\_\_

Offer Valid In U.S. And Possessions Only. Please allow 30 to 60 days for delivery of first issue.



# Performance BIOS

## A low-cost way to improve the performance of your IBM PC.

- Plug-in replacement for the original BIOS ROM.
- Faster floppy disk writes.
- Faster console output.
- ANSI console driver in place of "dumbTTY."
- Serial printer support.
- Auto search for expansion BIOS ROMs.
- And more...

### PC Performance Inc.

117 N. First St. • Ann Arbor, MI 48104  
(313) 761-9347

CIRCLE NO. 147 ON READER SERVICE CARD

## the RTool

Experts need expert tools. The correct tool, close at hand, saves you time and gives you the leverage to get results fast.

RTool is a new concept in programming aids, a powerful set of **resident** general purpose tools that you can awaken with a single keystroke. RTool eliminates the need for manuals, scratchpaper, and printouts, saving you time when time is money. And, like any good tool, RTool is easy to use.

Use RTool to capture and save screen images, scan and load disk files, and access on-line help. Create and save keyboard macros. Submit block text to the keyboard. List, rename, and delete files. Change directories. And much more. All with a few keystrokes. Even when another program is being used.

RTool closes the loop between the keyboard, display, and disk drives, letting them communicate with each other in a simple and consistent way. Think of RTool as a set of



**BitWit Software**

3790 El Camino Real, #205  
Palo Alto, CA 94306  
415/494-2611

powerful new  
features for **every**  
program you own.

Available for the PC/XT,  
PCDOS 1.1/2.0. Write  
for free literature  
or a demo disk (\$15).

CIRCLE NO. 112 ON READER SERVICE CARD

## WORKSHEET FILES

number 3 is displayed as row 4, column number 0 is displayed as column A, etc. Cells are stored in order, beginning with the upper left portion of the worksheet, proceeding from left to right within rows and from the top row to the bottom.

When a portion of a worksheet is saved (for example, with a /File Extract Value instruction), cell locations are converted to those that would have been applicable if the portion had been in the upper left corner of the worksheet. For ease of interpretation, a cell's location can

***P**rocessing the header  
(type 0) record is not  
strictly necessary.*

*However, checking its  
validity is always wise.*

be printed in "external" terms—that is, as it would be displayed. Lines 680-760 contain a procedure designed to show the location of a cell in ROW% and COLUMN%.

In each of the four types of data records—13, 14, 15, and 16—the first byte indicates the format to be used when displaying the contents of the cell, and the next four bytes indicate the column and row numbers in which the cell is located. The procedure between lines 570 and 660 processes the first five bytes of a data record. After this has been run, the procedure beginning at line 680 can be used to print the row and column in "display" terms.

The simplest data record is type 13, which contains an integer value stored in two bytes. The location and contents of such records are obtained and printed with the procedure between lines 1340 and 1410.

Numeric data not stored as two-byte integers are stored as eight-byte (double-precision) floating-point numbers, such as are present in records of type 14.

Unfortunately, double-precision numbers are stored in one format by



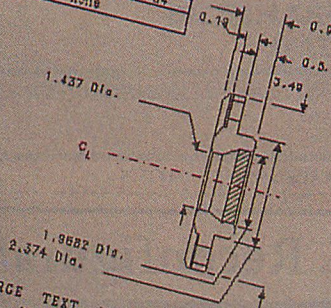
# IBM PC. WANG WP. TEKTRONIX PLOT 10. ANSI GKS. ALL ON ONE PAGE!

## CONCEPT 100

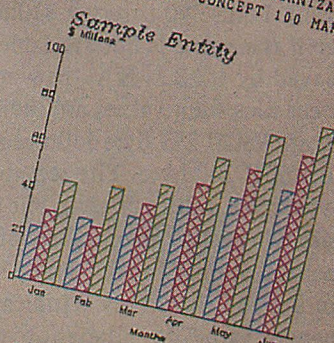
IMMEDIATELY COMPATIBLE WITH YOUR EXISTING IBM SOFTWARE, CONCEPT 100 TURNS THE IBM PC OR XT INTO A HIGH-PERFORMANCE DOCUMENT PROCESSOR. It incorporates WANG-like word processing, with powerful extras. It implements a Virtual Device Interface based on the ANSI GKS standards. And it enhances the resolution of your IBM monitor to 720x352 pixels for fast, smooth graphics.

CONCEPT 100 PERMITS POWERFUL GRAPHICS EDITING, INCLUDING MOUSE-DRIVEN DRAWING. OPTIONAL TEKTRONIX TERMINAL EMULATION PROVIDES PLOT 10 COMPATIBILITY.

CART OPEN ECG. 023P  
Preliminary only  
Dwn By GDS/05-10-84  
Scale: None



NEED TO ADD STATISTICAL GRAPHS TO YOUR REPORTS? ORGANIZATIONAL CHARTS? MAPS? CONCEPT 100 MAKES IT EASY.



MERGE TEXT AND GRAPHICS WITH INFINITE VERSATILITY. CONCEPT 100 is designed for high-volume, multi-page professional documents used in applications from engineering to management. It is compatible with a full range of output options, from dot matrix to laser printers.

NEED SPECIAL FONTS AND TECHNICAL TYPE STYLES? ORDER THEM FROM A LARGE VARIETY OF OPTIONS.

### DISCRETE COSINE TRANSFORM

$$F(u,v) = \sum_{j=0}^{N-1} \sum_{k=0}^{M-1} f(j,k) c(u,v,j,k)$$

BASE PRICE: JUST \$2195. FOR MORE INFORMATION ON CONCEPT 100, CALL THE TOLL-FREE NUMBER LISTED BELOW.

Printed on an IDS Prism 132.

Concept Technologies, Inc.  
P.O. Box 5277  
Portland, OR 97208  
1-800-547-4000



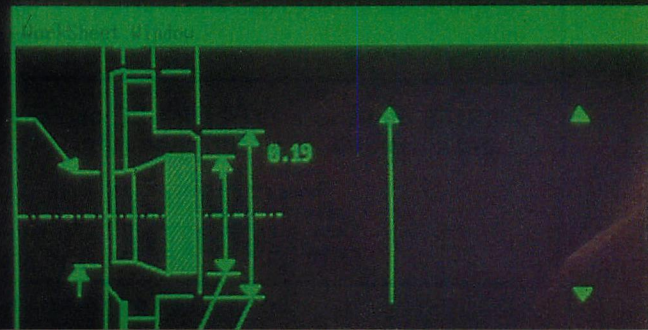
Here's documented proof that full-function word-and-graphics processing is practical at last.

What you see is what you get: text, charts and quality graphics, easily produced and merged on the IBM PC or XT, then output together. Concurrent rasterization lets your printer turn out highest-resolution results while you turn the computer to other tasks.

Produce your own proof: call to arrange for a demonstration today: 1-800-547-4000. In Oregon (503) 684-3314.

## CONCEPT TECHNOLOGIES: THE DOCUMENT PROCESSORS

CIRCLE NO. 120 ON READER SERVICE CARD





# PROGRAMMING UTILITIES for IBM PC BASIC

Input up to 13 IBM PC BASIC Program files	<b>Full Format Listing Utility</b> <b>Cross Reference Utility</b> <b>Search and Replace Utility</b> <b>Compress Code Utility</b> <b>Decompress Code Utility</b> <b>Compare Files Utility</b>	Output Accurate, useful easy-to-read listing
--	---	---

By batching input, Programming Utilities for BASIC reduces operator time and attendance. Up to 13 IBM PC BASIC program files can be submitted to any combination of utilities. Programming Utilities for BASIC allows easy documentation of programs, simplifies debugging of BASIC code and increases development efficiency. Send for complete information.

**Programming Utilities for IBM PC BASIC ... \$199.00**  
**Demo Disk and Manual (Credits to purchase) ..... \$30.00**

Dealer inquiries welcome.



**ADVANCED PROGRAMMING  
TECHNOLOGIES, INC.**

8704 West Brown Deer Rd., Suite 132, Milwaukee, WI 53224  
(414) 251-8880

CIRCLE NO. 101 ON READER SERVICE CARD

## WORKSHEET FILES

1-2-3 and in another by Microsoft BASIC. All double-precision numbers in worksheet files are stored in the format used by the Intel 8087 coprocessor. The eight bytes representing such values are stored "backwards" on the file. To be used in programs written in Microsoft BASIC, such values must be converted. Some compilers for other languages (for example, Pascal and C) do not suffer from this drawback.

It is possible to call up an assembly-language routine designed to perform such a conversion from a BASIC program. Details can be found in Richard Startz's book, *8087 Applications and Programming for the IBM PC and Other PCs* (Brady, 1983). See listing 1, in which a procedure in Microsoft BASIC (beginning at line 780) is used.

The procedure to convert the double-precision value is rather inelegant. Lines 790 through 810 test to see if the value is not available (displayed by 1-2-3 as NA). In worksheet files such values are indicated by an ASCII 255 byte followed by an ASCII 240 byte. The remaining bytes have values of zero, but the first two suffice for purposes of identification. Line 820 and 830 test for a zero value. This is indicated by zero values for all eight bytes, but inspection of the first two suffices. The remainder of the procedure performs the conversion.

Double-precision value records are processed beginning at line 1430. Lines 1460 through 1490 get the eight bytes containing the value, putting the numeric values of the bytes in vector `BYT%`. The bytes are put in "backwards" — the value of the first in `BYT%(8)`, the second in `BYT%(7)`, etc.

When vectors `BYT%(1)` through `BYT%(8)` are ready, the conversion procedure is called. The result is returned as `DOUBLE#` (a double-precision number) unless `ISNA%` equals 1. In the latter case, the cell contains an NA. Line 1510 prints either the value or NA.

## Intuitive. Powerful. Reconfigurable.

# BRIEF™

## The Programmer's Editor

### Intuitive.

Thoughts flow smoothly. 15 minutes is all it takes to be productive with BRIEF. Modeless operation gives you immediate access to the functions of this fast, memory-mapped editor.

### Powerful.

You'll edit effortlessly, without worrying about mistakes or repetitive nuisances. BRIEF has every feature you'd expect, plus full Undo, multiple files and windows, language sensitive features, a complete, powerful, readable, compiled Macro language, and much more.

### Reconfigurable.

BRIEF is distributed in an "ideal" configuration, and many use it as-is. But you may want to make changes. Reconfigure the keyboard. Modify the way commands work. You can change almost anything in BRIEF — to fit your style.

### Reward!

\$1,000 and substantial recognition will be given for the "Outstanding BRIEF Macro." Prizes will also be given for other winning entries made by 11/31.

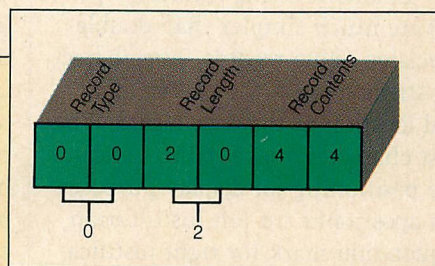
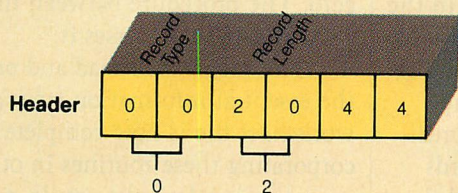
**BRIEF requires a 192K IBM PC or Tandy 2000, with DOS 2.0+, and costs \$195. Call for more info., or about the contest.**

**Solution  
Systems™**

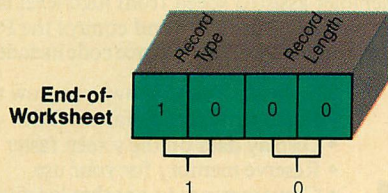
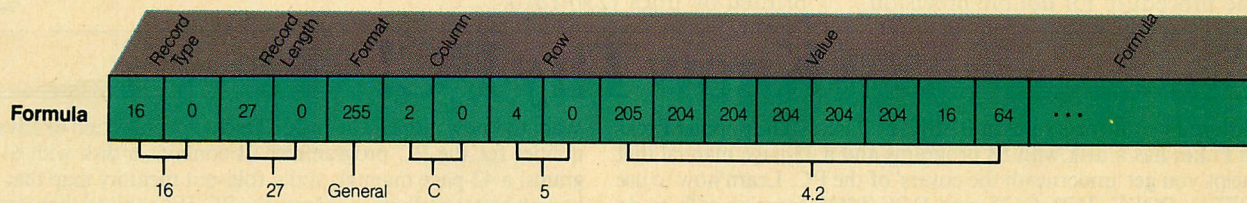
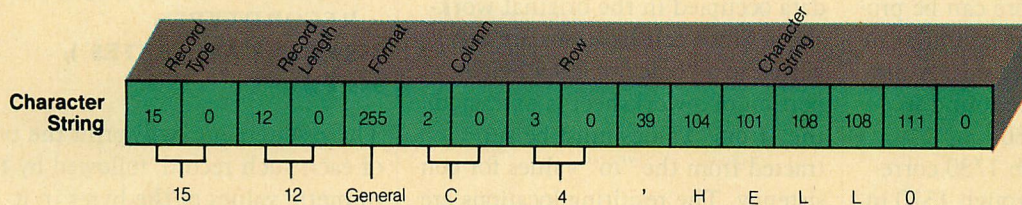
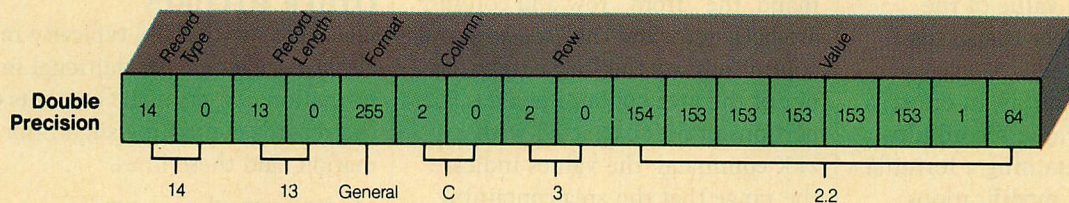
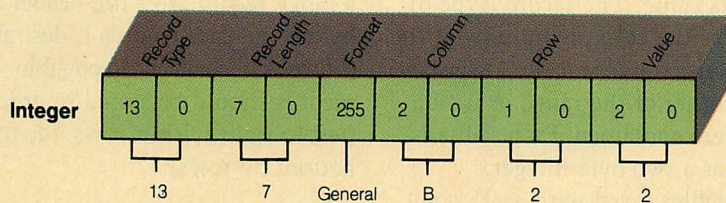
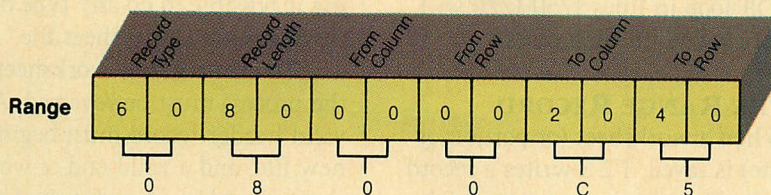
335-P Washington St.  
Norwell, Mass. 02061  
617-659-1571

CIRCLE NO. 239 ON READER SERVICE CARD





**Figure 1: General Structure of a Worksheet Record**



**Figure 2: Examples of Worksheet Records**



## WORKSHEET FILES

Character string records (type 15) are much simpler than double-precision value records. The character string follows the cell format and location in the data record. The first character of the string indicates the positioning for display purposes (an apostrophe for left justification, a quotation mark for right justification, a caret for centering, etc.). The last character is an ASCII 0 (null). The requisite procedure runs from line 1540 through line 1630.

Since five bytes are used for the record format, row, and column, the string is stored in the remaining (RECORDLENGTH%-5) bytes. These are assembled into a CHAR-STRING\$, which is then printed.

Much of the power of 1-2-3 comes from its use of formulas, which indicate how the value in a cell is to be calculated. A formula record (type 16) is used for any cell with such a formula. Fortunately, the last calculated value of the formula (the number that is displayed) is also stored.

A formula record is, in effect, a double-precision value record plus a series of bytes containing a formula. With some minor modifications, type 16 records therefore can be processed in a manner that is similar to that used for type 14 records. A procedure to do this can be found in lines 1650 through 1780.

Lines 1660 through 1730 correspond to lines 1440 through 1510 in the procedure for double-precision

values. Lines 1740 through 1770 take care of the formula information. The format, cell location, and last computed value require 13 bytes, so the formula is stored in the remaining (RECORDLENGTH%-13) bytes, which are simply read and ignored. If desired, this procedure could also be used for double-precision values, since type 14 records have a record length of 13, and the FOR loop in lines 1750-1770 will not execute in such cases.

### THE RANGE RECORD

When a worksheet (or portion of one) is saved, 1-2-3 writes a record indicating the range from which the data came. The record (type 6) indicates the column and row at the upper left corner and the lower right corner of the range in which data were contained. Each value is stored as a two-byte integer.

For files saved with a /FS command, the "from" row and column are both zero, and the "to" row and column indicate the lower right corner of the area containing data. For portions of files extracted with a /FX command, the values indicate the range that the area containing data occupied in the original worksheet. Since cell locations are converted to a "base" of 0,0 when a portion of a worksheet is extracted, the "from" values must be subtracted from the "to" values for consistency. The resulting locations are printed by lines 1290-1310.

### THE END-OF-WORKSHEET RECORD

The last record in a valid worksheet file is of type 1 and has a length of zero. The procedure between lines 1800 and 1820 processes it.

The program to read and print the essential information from a worksheet file is now complete. Incorporating these routines in other programs is relatively simple, making it possible to do any type of processing with a worksheet file.

To create a new worksheet file, the process must be reversed. A valid header record must begin the new file, and a valid end-of-worksheet record must end it. Including a range record after the header and before the data records is desirable (but not necessary). If possible, data records should be stored in order (left-to-right within rows, top-to-bottom by rows).

### OTHER RECORDS

Files saved with 1-2-3 typically include a great deal of additional information. To print the contents of the records containing such information, add these lines:

```
305 PRINT "Record Type ";  
      RECORDTYPE%  
335 PRINT ASC (BYTES$ );  
345 PRINT
```

These statements will print the type of each such record, followed by the numeric values of the bytes in it.

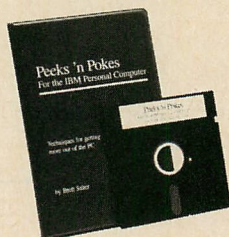


## Know Thy PC!

Are you writing programs in BASIC or Pascal? The popular **Peeks 'n Pokes** has a disk with 58 programs and a 38-page manual that helps you get 'underneath the covers' of the PC. Learn how to use PEEK, POKE, INP, OUT, and DOS/BIOS function calls to do what you want, fast! Do you want to perform functions not available from BASIC or Pascal? It's all explained in the manual and demonstrated in the sample programs. Source code included!

**Peeks 'n Pokes** shows you how to:

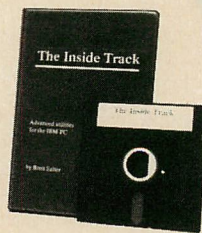
- Access the system's configuration
- Unprotect BASIC programs
- Scroll part or all of the screen
- Access the file directory
- Logically swap printers
- Read and change the keyboard
- Find more Peeks and Pokes
- And much more... for only \$30.00



Want to know more? **The Inside Track!** is a collection of advanced utilities for the PC programmer. It contains a disk with 61 programs, a 42-page manual, and a fold-out memory map that helps you get better performance from the PC. With this package you can give your programs assembler-assisted speed from high-level languages, get control over memory, customize and control the PC, and more. Some programs require DOS 2.00. Source code included!

**The Inside Track!** shows you how to:

- Read/write files as fast as DOS
- Display data on the screen faster
- Reserve memory for your use
- Copy memory to another location
- Copy-protect your programs
- Load large programs faster
- Control the keyboard settings
- And much more... for only \$45.00



MasterCard and VISA accepted. Shipping charges: \$2.50 per order for UPS; \$2.50 per item for First Class Mail to USA and Canada; \$6.00 per item for Air Mail outside USA and Canada. Dealer inquiries invited.

**Data Base Decisions • 14 Bonnie Lane • Atlanta, GA 30328 • 404/256-3860**

CIRCLE NO. 137 ON READER SERVICE CARD



When you visit your dealer and compare the Princeton IBM-compatible HX-12 side-by-side with the IBM color monitor, your eyes will see the difference.

The HX-12 gives you higher resolution and finer dot pitch (.31mm) than the IBM 5153's medium resolution (.43mm) for a cleaner, sharper image.

Compare our full range of colors and our crisp whites without red bleed. You'll also see a difference in our non-glare screen—a feature your eyes will really appreciate in a long work session.

The Princeton HX-12 comes with a cable that plugs directly into the IBM PC, ready to burst forth into 16 superb colors. All at a suggested retail price (\$695) that's a pleasure for sore eyes and overworked budgets.

**Apple IIe users:** call us to learn how you, too, can now enjoy the visible superiority of the Princeton HX-12.

Ask your local dealer for a demonstration and let your eyes decide. Or call us at 800-221-1490 for more information and the name of your nearest dealer.

If you're ready to move up to color, graduate to the Princeton HX-12. It's right at the head of its class.

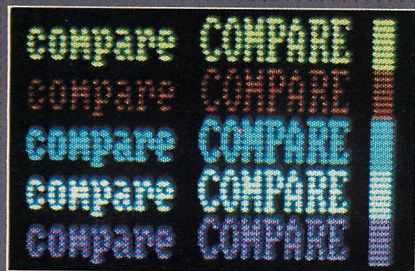
Now available at Computerland, Entre and local independent computer dealers.

Nationwide service provided by Bell and Howell Service Company and MAI Sorbus Service Company.

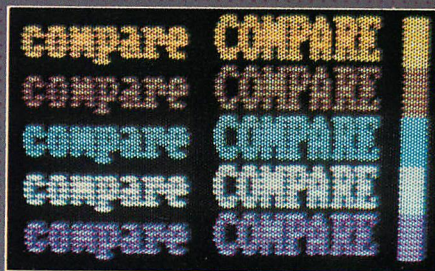
**PGS** Princeton  
Graphic Systems  
an Intelligent Systems Company

1101-I State Road Princeton New Jersey 08540  
(609) 683-1660 TLX:6857009 PGS Prin.  
800-221-1490

## DON'T COMPROMISE:



**OURS:** .31 mm dot pitch, 80 column text.



**THEIRS:** .43 mm dot pitch, 80 column text.

### THE PRINCETON HX-12 HIGH RESOLUTION RGB COLOR MONITOR

for the image  
your eyes deserve

NEW: adapter  
available for PCjr.





## Listing 1 INSIDE.BAS: A Program to Print Data in a Worksheet File

```

10 ' Program to print data in a Worksheet File
20 ' W. F. Sharpe, February 1984
30 '
40 ' Main Program
50 GOSUB 120 ' open file
60 RECORDTYPE% = 0
70 WHILE RECORDTYPE% <> 1
80 GOSUB 210 ' read and process a record
90 WEND
100 END
110 '
120 ' Procedure to open the worksheet file
130 INPUT "Worksheet name: "; FLNAME$
140 FLNAME$=FLNAME$+".WKS"
150 OPEN FLNAME$ AS 1 LEN=128
160 FIELD #1, 128 AS BUFFER$
170 GET #1
180 POINTER% = 1
190 RETURN
200 '
210 ' Procedure to read and process a record
220 GOSUB 370 ' read record type and length
230 ' go to appropriate routine for processing
240 IF RECORDTYPE% = 0 GOTO 1010 ' header
250 IF RECORDTYPE% = 6 GOTO 1120 ' range
260 IF RECORDTYPE% = 13 GOTO 1340 ' integer value
270 IF RECORDTYPE% = 14 GOTO 1430 ' double precision value
280 IF RECORDTYPE% = 15 GOTO 1540 ' character string (label)
290 IF RECORDTYPE% = 16 GOTO 1650 ' formula and value
300 IF RECORDTYPE% = 1 GOTO 1800 ' end of worksheet
310 ' not a type to be processed -- read remaining portion
320 FOR I%=1 TO RECORDLENGTH%
330 GOSUB 480 ' get the next byte
340 NEXT I%
350 RETURN

```

```

360 '
370 ' Procedure to get the type and length of the record
380 ' get record type
390 GOSUB 480
400 GOSUB 480
410 RECORDTYPE% = CVI ( PREVIOUSBYTES$ + BYTES$ )
420 ' get record length
430 GOSUB 480
440 GOSUB 480
450 RECORDLENGTH% = CVI ( PREVIOUSBYTES$ + BYTES$ )
460 RETURN
470 '
480 ' Procedure to get the next byte
490 PREVIOUSBYTES$ = BYTES$
500 BYTES$ = MID$(BUFFER$,POINTER%,1)
510 POINTER% = POINTER% + 1
520 IF (POINTER% <= 128) THEN RETURN
530 GET #1
540 POINTER% = 1
550 RETURN
560 '
570 ' Procedure to get format, row and column for a data record
580 GOSUB 480
590 FORMATBYTES$=BYTES$
600 GOSUB 480
610 GOSUB 480
620 COLUMN% = CVI ( PREVIOUSBYTES$ + BYTES$ )
630 GOSUB 480
640 GOSUB 480
650 ROW% = CVI ( PREVIOUSBYTES$ + BYTES$ )
660 RETURN
670 '
680 ' Procedure to print cell location
690 ' convert column to alphabetic characters
700 CHAR1% = COLUMN% \ 26
710 CHAR2% = COLUMN% MOD 26
720 IF CHAR1% = 0 THEN ALPHA$ = " " ELSE ALPHA$ = CHR$(64+CHAR1%)
730 ALPHA$ = ALPHA$ + CHR$(65+CHAR2%)
740 ' print column and row

```

# POWER-BASE™ WITH DATAZOOM

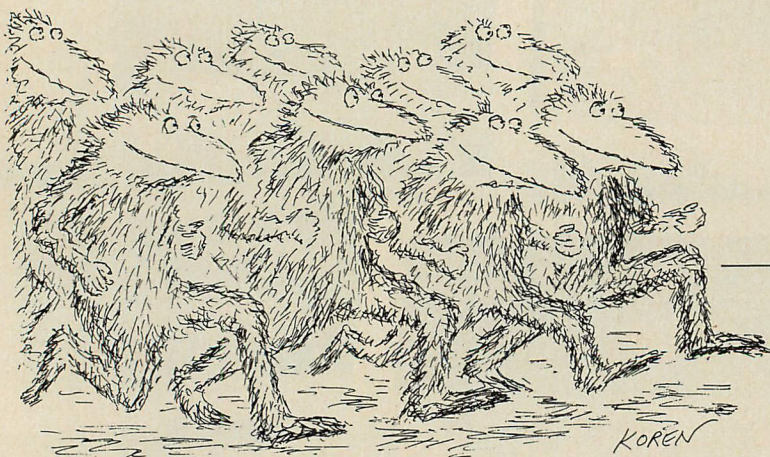
"Power-base™ is a menu-driven data management program with relational capabilities. It was the top-rated program overall, primarily because it was the easiest to learn and use, and rated highest in error handling."

*The Ratings Book/Software Digest, March 1984*

"To track the Bank of New England's IRA sales for all 16 branches, I chose Power-base™ because it responds so well to change while protecting the integrity of my database." *Bruce Montgomery, Bank of New England*

"This program is impressive—it's easy to use, simple, logical, and powerful and comes with flawless written documentation."

*Giovanni Perrone, InfoWorld, March 12, 1984*





```

750 PRINT ALPHA$; ROW%+1;
760 RETURN
770 '
780 ' Procedure to convert double precision number
790 ' test for NA code
800 IF ((BYT%(1)=255) AND (BYT%(2)=240)) THEN ISNA%=1 ELSE ISNA%=0
810 IF ISNA% = 1 THEN RETURN
820 ' test for zero
830 IF (BYT%(1)=0) AND (BYT%(2)=0) THEN DOUBLE#=0!: RETURN
840 ' get sign
850 IF ((BYT%(1) AND 128) >0) THEN SIGN%=-1 ELSE SIGN%=1
860 ' get exponent
870 BYT%(1) = BYT%(1) AND 127
880 BYT2LEFT% = (BYT%(2) AND 240)\16
890 BYT2RIGHT% = BYT%(2) AND 15
900 EXPONENT% = BYT%(1)*16 + BYT2LEFT% - 1023
910 ' get mantissa
920 SUM# = 0
930 FOR I% = 8 TO 3 STEP -1
940 SUM# = (SUM# + BYT%(I%)) / 256
950 NEXT I%
960 SIGNIFICAND# = 1 + (BYT2RIGHT%/16) + (SUM#/16)
970 ' compute value
980 DOUBLE# = SIGN% * (SIGNIFICAND# * (2^EXPONENT%))
990 RETURN
1000 '
1010 ' Procedure to process a header record (type 0)
1020 IF RECORLENGTH% <> 2 THEN GOTO 1090
1030 GOSUB 480
1040 IF BYTE$ <> CHR$(4) THEN GOTO 1090
1050 GOSUB 480
1060 IF BYTE$ <> CHR$(4) THEN GOTO 1090
1070 RETURN
1080 ' error -- halt processing
1090 PRINT "ERROR -- Not a Valid Worksheet File"
1100 END
1110 '
1120 ' Procedure to process a range record (type 6)
1130 ' find range from which data were saved

```

```

1140 GOSUB 480
1150 GOSUB 480
1160 FROMCOL% = CVI ( PREVIOUSBYTES$ + BYTES$ )
1170 GOSUB 480
1180 GOSUB 480
1190 FROMROW% = CVI ( PREVIOUSBYTES$ + BYTES$ )
1200 GOSUB 480
1210 GOSUB 480
1220 TOCOL% = CVI ( PREVIOUSBYTES$ + BYTES$ )
1230 GOSUB 480
1240 GOSUB 480
1250 TOROW% = CVI ( PREVIOUSBYTES$ + BYTES$ )
1260 ' find lower right corner
1270 ROW% = TOROW% - FROMROW%
1280 COLUMN% = TOCOL% - FROMCOL%
1290 PRINT "Lower Right Corner: ";
1300 GOSUB 680 ' print cell location
1310 PRINT
1320 RETURN
1330 '
1340 ' Procedure to process an integer record (type 13)
1350 GOSUB 570 ' get format, row and column
1360 GOSUB 680 ' print cell location
1370 GOSUB 480
1380 GOSUB 480
1390 VALUE% = CVI ( PREVIOUSBYTES$ + BYTES$ )
1400 PRINT TAB(9); VALUE%
1410 RETURN
1420 '
1430 ' Procedure to process a double precision value record (type 14)
1440 GOSUB 570 ' get format, row and column
1450 GOSUB 680 ' print cell location
1460 FOR I% = 1 TO 8
1470 GOSUB 480
1480 BYT%(9-I%) = ASC ( BYTES$ )
1490 NEXT I%
1500 GOSUB 780 ' convert to double-precision number
1510 IF ISNA% = 1 THEN PRINT TAB(9); "NA" ELSE PRINT TAB(9); DOUBLE#
1520 RETURN

```

# S WAY AHEAD OF EVERYTHING.

"Because you don't have to wade through screens full of menus, the program is fast. Because your choices are always in front of you, the program is easy. Not much more you can ask for, is there?"

Bobbi Bullard, *Computer Retailing*, April 1984

"Much to my surprise, my search for a data-base system took six months. But at last I've come up with a winner: Power-base."

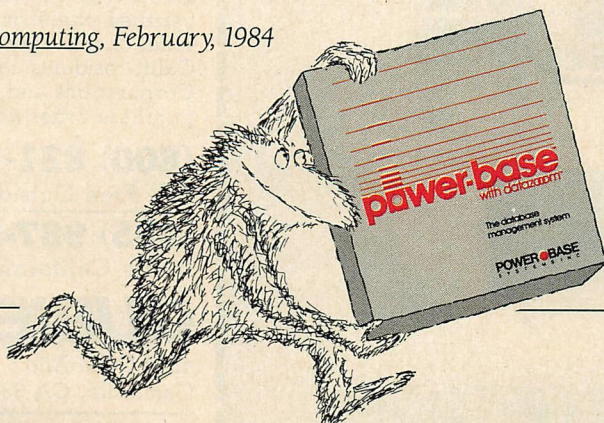
Paul Bonner, *Personal Computing*, February, 1984

Visit your local computer dealer and experience Power-base™ for yourself.

PowerBase Systems, Inc., 12 West 37th Street, New York, NY 10018 (212) 947-3590



WE MADE IT POWERFUL.  
BUT WE KEPT IT SIMPLE.





# Hard Disk, Soft Shell

## The Complete Hard Disk Solutions

For Desktop & Portable PC's 10 Megabytes \$888, Or 20 Meg \$1288.

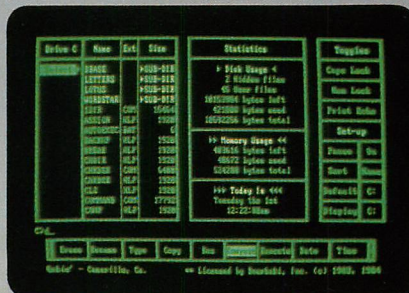
We have the whole package you need to add a hard disk to your IBM PC or compatible. Our half-height 10 and 20 megabyte drives have the lowest current draw in the industry. Unlike most aftermarket hard disks ours can "boot" direct from the hard disk. No software patches, or drivers to install just a copy of IBM PC DOS 2.0 or 2.1.

**1dirfully Easy** with the popular 1dir menu driven "visual shell" software. It replaces complicated DOS commands with menus that allow you to just point at what you want to do. Help files explain DOS commands and give you on-line advice when you need it. 1dir takes the wonder out of the tree structured subdirectories so useful in organizing a hard disk.

**Hard Problems** like excessive current draw and heat have until now been unsolved problems with aftermarket hard disks. Most drives draw lots of power. If your PC has many expansion boards in it, power to run a hard disk is probably not available. Hard disks have also been easily damaged by vibration and movement. And of course the problem any non-IBM product must face, compatibility with the IBM PC. We have tackled all these problems and come up with the best solutions available at any price.

**Cool & In Control** with half-height drives so efficient they draw the same amount of power as a floppy disk drive. This means a minimum of heat inside your PC with more power available for expansion boards. The controller uses LSI technology to provide fewer components, drawing less power, and giving significantly improved performance over the IBM XT.

**The Portable Plus** is 10 or 20 megabytes to go. In fact, the drives we use have been selected by several computer makers for use in their portable computers. Their plated recording media helps withstand vibration, and allows the drive to be used at any angle.



**Total Compatibility** is a necessity. Our hard disks have the ability to boot directly from the hard disk. Check around, very few aftermarket systems can. In fact, all you need is a copy of DOS 2.0 or 2.1 and you are ready to go, no software drivers to install, or DEBUG patches to apply.

**Why Buy From Us?** It's simple really. Better value, and no hassles. You see, the price advertised is the whole price. No extra for freight, credit cards, COD fees, or insurance. Perhaps the best part is if you have a question you deal direct with Qubie'. We have the knowledge and ability to

help you quickly. And, if you do have a hardware problem during the warranty period it is fixed or replaced within 48 hours!

**No Risk.** Don't be afraid to save. Our manual is written so even the novice can successfully install his own system. And remember, if for any reason you are not happy within 30 days of purchase you may return it for a full refund, and we'll pay the freight back! Get our competition to make the same offer, and find out which system is best. We know which one you will choose.

**System Requirements:** Any IBM PC with 64k RAM and PC DOS 2.0 or later. Compatible owners call for application information.

**PC10:** Includes 10 Megabyte drive, controller, cables, installation instructions, 1dir software, and 1 year warranty. **\$888**

**PC20:** Same as above with 20 Megabyte drive. **\$1288.**

**Options:** Auxiliary power supply, for those with computers already full of power hungry expansion boards. #PCPWR \$88.

Half-height bezel (specify computer). #HHBZL \$15.

**DEALER AND QUANTITY PURCHASE INQUIRIES INVITED**

### Order Today, Shipped Tomorrow!

Price includes UPS surface freight and insurance. Add \$12 for two day air service. For fastest delivery send certified check or credit card. Personal checks take 18 days to clear. Calif. residents add 6% sales tax. Corporations and Institutions call for purchase order details.

**(800) 821-4479**

Toll Free Outside California

**(805) 987-9741**

Inside California

**QUBIE'**

4809 Calle Alto  
Camarillo, CA 93010

Tempo House, 15 Falcon Road,  
London SW11, United Kingdom

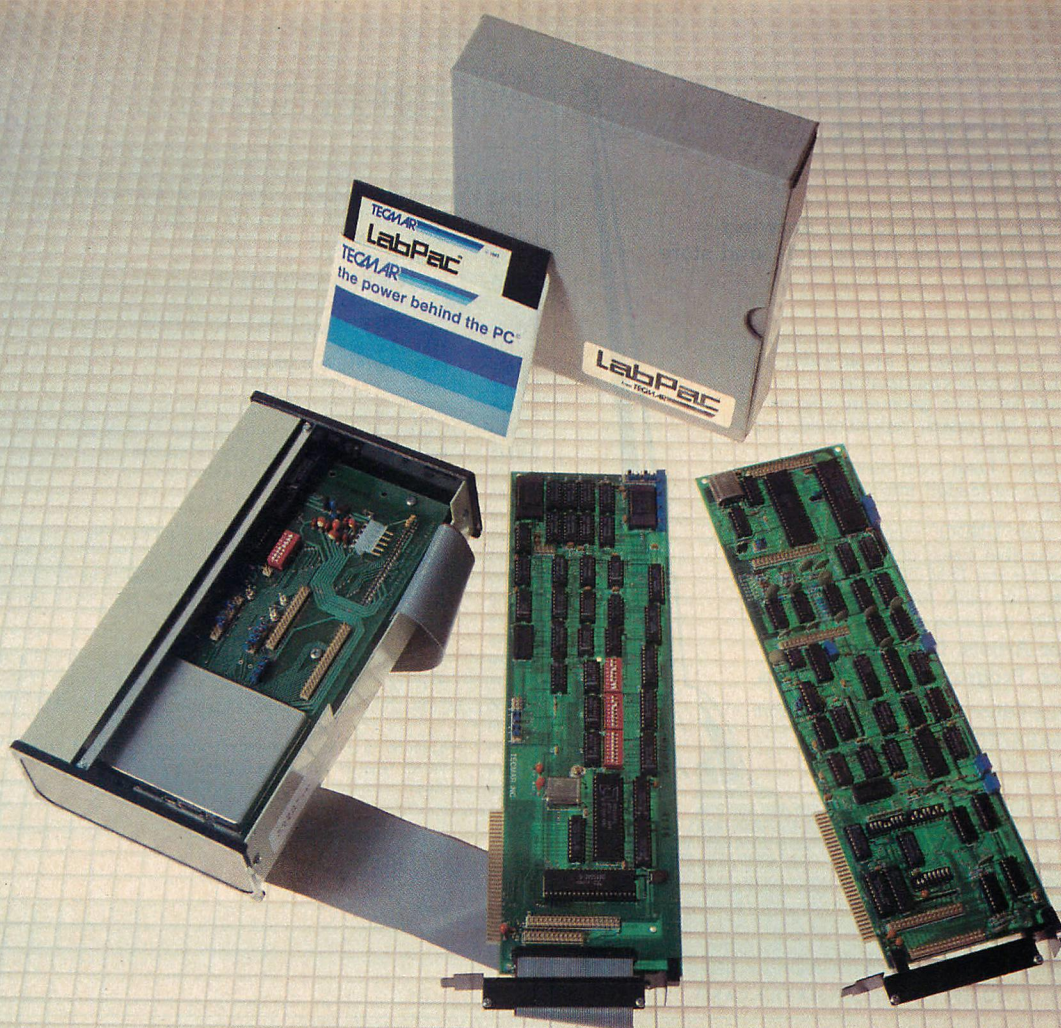
9/62 Blackshaw, Mortdale  
2223 N.S.W., Australia



**1dir Directory System Included**

CIRCLE NO. 224 ON READER SERVICE CARD





# Tecmar Provides Solutions

## LabPac™ makes data acquisition quick and easy

Save your valuable time and money with LABPAC from Tecmar. Instead of spending days slaving over complex programs and languages, your data acquisition system can be up and running in hours. Now even novice programmers can easily design highly sophisticated data acquisition and process control systems. LABPAC provides a library of advanced assembly language subroutines that can be called by your BASIC, FORTRAN or Pascal programs. These subroutines can sample a channel, convert the signal, and store the value in memory for later use. LABPAC also contains many specialized commands for more complex procedures. In addition to all this, LABPAC also can operate in the background allowing you to sample, store, and analyze your data at the same time. LABPAC is compatible with the Tecmar Lab Master, Lab Tender and DADIO boards.

### Lab Master™

End the tedium of monitoring your experiments or processes with the Lab Master. The Lab Master lets you save time and money by having your PC do the work for you. This board is powerful enough for the most demanding lab or industrial applications, yet with the LABPAC software support package it is easy to use. With Lab Master you have complete control over A/D conversion, D/A conversion, counting, timing, and digital I/O. This board is so advanced it can sample (with options) up to 256 channels of data and can convert a single channel up to 80,000 times in one second. The Lab Master doesn't sacrifice accuracy, since it comes with 12-bit precision, and has options for 14 and 16 bit accuracies. However, the most amazing feature of the Lab Master is that it can do all this and still cost less than \$1,000.

### Lab Tender™

The Lab Tender is the economical solution to your data acquisition needs. Whether you are on a tight budget or simply don't need all the precision of the Lab Master, the Lab Tender is the perfect board for you. The Lab Tender offers 32 channels of 8-bit A/D and 16 channels of 8-bit D/A, at a conversion rate of 50,000 samples per second. It also has counting, timing and digital I/O capabilities. No one else can offer you this combination of features for less than \$500.

### DADIO™

The DADIO extends the capabilities of the Lab Master or Lab Tender boards by providing 4 additional D/A channels and 3 I/O ports.

**TECMAR**  
the power behind the PC™



# G Graphics Editor

A Fast, Powerful, Easy to Use drawing program that lets you create, edit, and store colorful images

- Intricate detail
- Easy to remember, single key commands
- Variable cursor speed & brush width
- User defined color combinations
- Commands for basic geometric shapes
- Images can be erased, repositioned, copied, mirrored, flipped
- Save to disk / Load from disk
- Images can be loaded into user's BASIC programs
- "HELP" and "UNDO" commands
- Text in variable sizes, colors, directions
- Designed for the IBM PC and compatible machines with 128K RAM, single disk drive, color graphics capability

Perfect for Artists, Designers, Animators, Programmers, Educators

G Graphics Editor is available for \$95 from  
MICRO MARKETING ASSOCIATES  
3497 East Livingston Avenue  
Suite A  
Columbus, Ohio 43227  
(614) 231-4956

CIRCLE NO. 163 ON READER SERVICE CARD

## WORKSHEET FILES

```

1530 '
1540 ' Procedure to process a character string record (type 15)
1550   GOSUB 570 ' get format, row and column
1560   GOSUB 680 ' print cell location
1570   CHARSTRING$ = ""
1580   FOR I% = 1 TO (RECORDLENGTH% - 5)
1590     GOSUB 480
1600     CHARSTRING$ = CHARSTRING$ + BYTE$
1610   NEXT I%
1620   PRINT TAB(9); CHARSTRING$
1630   RETURN
1640 '
1650 ' Procedure to process a formula record (type 16)
1660   GOSUB 570 ' get format, row and column
1670   GOSUB 680 ' print cell location
1680   FOR I% = 1 TO 8
1690     GOSUB 480
1700     BYT%(9-I%) = ASC ( BYTE$ )
1710   NEXT I%
1720   GOSUB 780 ' convert to double-precision number
1730   IF ISNA% = 1 THEN PRINT TAB(9); "NA" ELSE PRINT TAB(9); DOUBLE#
1740 ' read past formula bytes
1750   FOR I% = 1 TO (RECORDLENGTH% - 13)
1760     GOSUB 480
1770   NEXT I%
1780   RETURN
1790 '
1800 ' Procedure to process an end-of-worksheet record (type 1)
1810   PRINT "End of Worksheet File"
1820   RETURN
  
```



## LATTICE® C Compilers

"My personal preferences are Lattice C in the top category for its quick compile and execution times, small incremental code, best documentation and consistent reliability;..."

BYTE AUG. 1983  
R. Phraner

"...programs are compiled faster by the Lattice C compiler, and it produces programs that run faster than any other C compiler available for PC-DOS."

PC MAGAZINE JULY 1983  
H. Hinsch

"...Microsoft chose Lattice C both because of the quality of code generated and because Lattice C was designed to work with Microsoft's LINK program."

PC MAGAZINE OCT. 1983  
D. Clapp

"Lattice is both the most comprehensive and the best documented of the compilers. In general it performed best in the benchmark tests."

PERSONAL COMPUTER AGE NOV 1983  
F. Wilson

"This C compiler produces good tight-running programs and provides a sound practical alternative to Pascal."

SOFTALK AUG 1983  
P. Norton

"...the Lattice compiler is a sophisticated, high-performance package that appears to be well-suited for development of major application programs."

BYTE AUG 1983  
Houston, Brodrick, Kent

To order, or for further information  
on the LATTICE family of compilers, call or write:

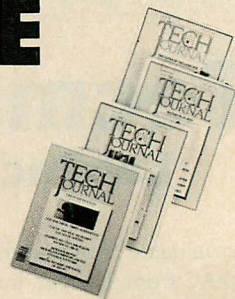


LATTICE, INC.  
P.O. Box 3072  
Glen Ellyn, IL 60138  
(312) 858-7950 TWX 910-291-2190



CIRCLE NO. 128 ON READER SERVICE CARD

## COMPLETE YOUR LIBRARY OF TECH JOURNAL



Add to your PC TECH JOURNAL collection today. Make your personal library complete and authoritative with any issues you may be missing.

Copies are available for issues published during the last twelve months—be sure to specify the issues you want. If a particular issue is out of stock, your payment will be refunded promptly.

Back issues of PC TECH JOURNAL are priced at \$7.00 each, postpaid. Outside USA, \$8.00 each.

PC TECH JOURNAL  
CN 1914, Morristown, NJ 07960

MCBI

Please send issues of PC TECH JOURNAL listed below:

Issue	Qty.	Unit Price	Total Price
Payment Enclosed			\$

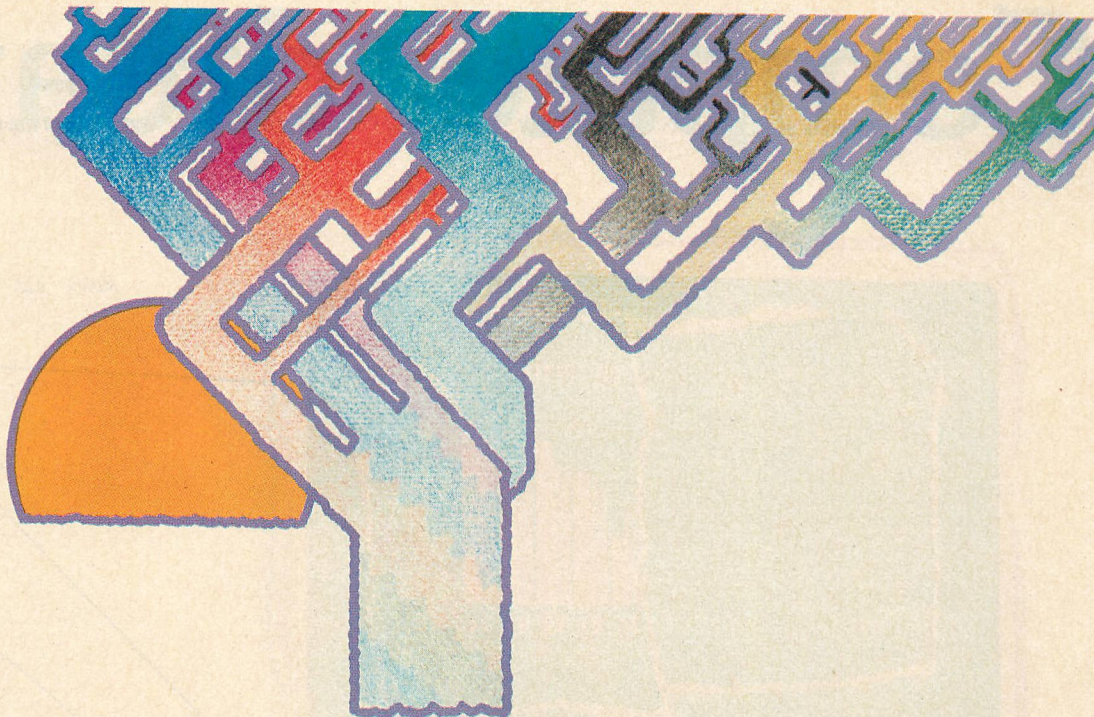
Mr./Mrs./Ms. \_\_\_\_\_ (print full name)

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

PC TECH JOURNAL





## Btrieve and Xtrieve. B-tree file access for all your programming languages. With the query tool your users demand.

Introducing a powerful data base combination for PC application developers. Btrieve™, the most sophisticated file access method for your IBM™ PC. In single user and network versions. And Xtrieve™, a new menu-driven query tool that gives you—and your users—fast access to information.

**Btrieve: for professional programmers.** Btrieve provides fast, flexible file management for all your application development. All your programming languages—BASIC, Pascal, Cobol, C. With multikey access to records. Automatic file recovery. Unlimited records per file. Duplicate, modifiable, and segmented keys. Variable cache buffer.

**Better applications faster.** Based on the b-tree file indexing system, Btrieve provides optimal file management and eliminates writing file management routines. So you can develop *better applications faster*.

**Xtrieve: easy window interface.** The ideal complement to Btrieve, Xtrieve is the non-programmer's inter-

face. Xtrieve's full relational capabilities let users define a virtual table of data from multiple files. Then Xtrieve speeds them through query building with a series of easy-to-follow windows.

**No command language.** Xtrieve is completely menu-driven, so there's no need to memorize command language. Or special syntax. Everything you need is on the screen. You and your users can perform unlimited queries—and get answers fast.

Xtrieve features a full range of restriction criteria. Online help messages. Automatic maintenance of information order by multiple indexes. And interfaces to access information from Lotus 1-2-3™ and dBase II® files.

**Network capabilities.** Network versions of Btrieve and Xtrieve allow data sharing in the most popular PC networks — PCnet™, NetWare™, EtherSeries™, MultiLink™, and OmniNet™.

For more information or to order, call or write:

 **SoftCraft Inc.**

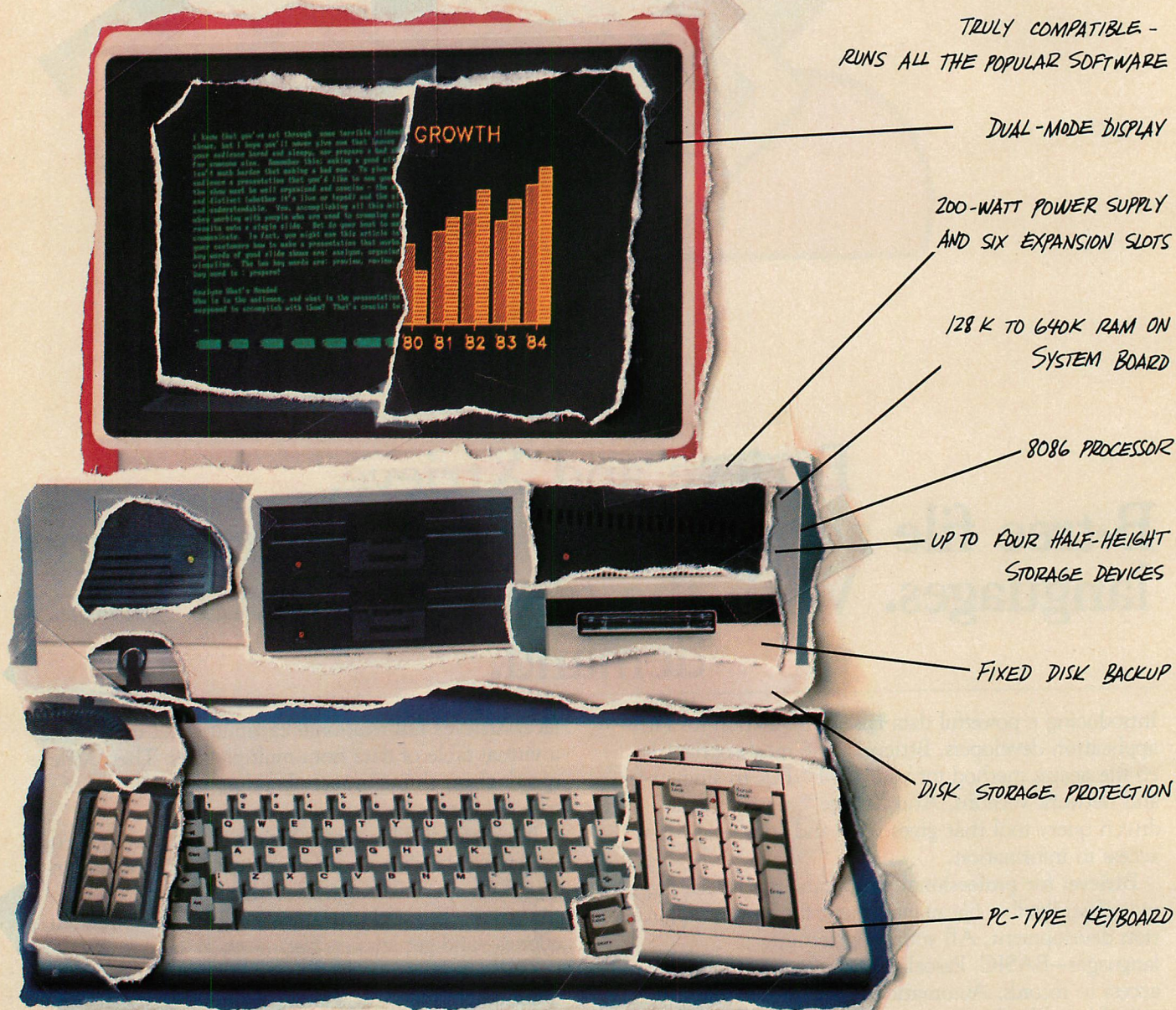
P. O. Box 9802 #590 Austin, Texas 78766 (512) 346-8380

Suggested retail prices: Btrieve, \$245; Xtrieve, \$195. Btrieve/N (network), \$595; Xtrieve/N, \$395. Dealer inquiries welcome. Btrieve requires PC-DOS or MS™-DOS 1.X or 2.X; Xtrieve, PC-DOS or MS-DOS 2.X.

Btrieve and Xtrieve, IBM, 1-2-3, dBase II, PCnet, NetWare, EtherSeries, MultiLink, OmniNet, and MS are trademarks of SoftCraft Inc., International Business Machines, Lotus Development Corp., Ashton-Tate, Orchid Technology, Novell Data Systems, 3Com Corp., Davong Systems Inc., Corvus Systems, and MicroSoft Inc.



# Computer dreams.



Introducing the new COMPAQ DESKPRO.<sup>®</sup> COMPAQ combined the best features of the best desktop computers. And then added exclusives you won't find on others. Today they're together in *one* personal computer. The COMPAQ DESKPRO.

The COMPAQ DESKPRO is the most expandable desktop you can buy. It can grow as you grow, with up to six available expansion slots and four storage devices, including a unique fixed disk drive backup—all *inside the computer instead of out*, saving your desk from clutter.

It's the most rugged desktop, too, because it's the only desktop with a shock-mounted mass storage compartment to help keep disk drives in alignment and help protect you from losing data, downtime, and dollars.

It's also the most compatible desktop, giving you true hardware and software compatibility with the industry's most popular personal computers. The COMPAQ DESKPRO runs thousands of programs written for the IBM<sup>®</sup> PC and XT right off the shelf. Which brings us to the next point.



# Dream computer.

*The industry leader in compatibility.*

*Text and graphics on one screen, not two.*

*Power and space for almost unlimited expansion.*

*Add up to 640K of memory on system board and save expansion slots.*

*Runs software 2X to 3X faster.*

*10MB fixed disk drive  
10MB fixed disk backup  
Two diskette drives*

*Exclusive tape backup helps protect data.*

*Unique shock mounting helps protect your data and hardware investment.*

*Familiar layout enhanced with LED's on caps and num-lock keys.*



The COMPAQ DESKPRO is the fastest truly compatible desktop you can buy. It's two to three times faster than the industry standard. That saves time now. And in the future, as software becomes more sophisticated and integrated, it will save you even more time as well as protect your personal computer investment.

But there's more. We gave the COMPAQ DESKPRO one other feature not found on any other machine. You can choose between an amber or green dual-mode monitor that displays high-resolution text *and* graphics with equal

brilliance, saving you the cost and clutter of a second monitor.

See the Dream Computer. Then pinch yourself. It's for real.

For the location of the nearest Authorized COMPAQ Computer Dealer, or for a free brochure, call 1-800-231-0900, Operator 5 or Telex #795437 COMPAQCOMP HOU.

*The New*

**COMPAQ**  
**DESKPRO™**

*It simply works better.*



# Drowning in a sea of solutions?

## Help's within reach...

Applications backlog. Technology blur. Mounting user pressures. Staying abreast of changing prices. A tidal wave of problems!

Even if some answers are available, you have to go to too many sources and sift through so much information, there's not enough time to locate the solutions to your immediate and most important problems.

Well, help IS within easy reach—in the form of an information system that displays all your current software, hardware and communications options for instant reference.

That system is DATA SOURCES, and you're invited to make it work for you. Simply fill in the coupon and we'll send you DATA SOURCES' 4 quarterly editions at 33% off their regular price.

What DATA SOURCES does is organize your options. It guarantees that you've considered all relevant products by guiding you to those with the best possibility of success.

DATA SOURCES is a conveniently sized, extremely well-organized and skillfully indexed 2-volume reference...maintained on a data-base, constantly updated and published quarterly.

### YOU GET...

**HARDWARE**—Over 16,000 products from Micros to Mainframes including peripherals—terminals, printers, memory devices, etc. ...organized by systems compatibility.

**SOFTWARE**—The largest available inventory of 18,000 business packages for micros, minis, and mainframes including operating systems, utilities, and application packages.



**COMMUNICATIONS EQUIPMENT**—From modems and multiplexors to local networks, carriers and services, plus all diagnostic and test equipment.

**SERVICES, SUPPLIER, SUPPORT**—Most complete organized listing of suppliers from installation design to maintenance and data center operations—over 8,000 companies.

### NEW FEATURES...

- ✓ **Software Index—by package name.**
- ✓ **Quick-reference product comparison charts.**
- ✓ **Before-you-buy selection criteria and checklists.**
- ✓ **Product Hotline—the very latest information on products announced between issues of Data Sources.**

### ORDER NOW AND SAVE \$60

**Yes!** Rush me the latest two-volume edition of DATA SOURCES and enter my subscription at \$150.00 for 4 quarterly editions. I save a full 33% off the regular price of \$210.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone \_\_\_\_\_

Nature of Company's Business \_\_\_\_\_

Please check appropriate box: ☐ END USER ☐ VAR/OEM

☐ DISTRIBUTOR ☐ DP MFG ☐ OTHER \_\_\_\_\_

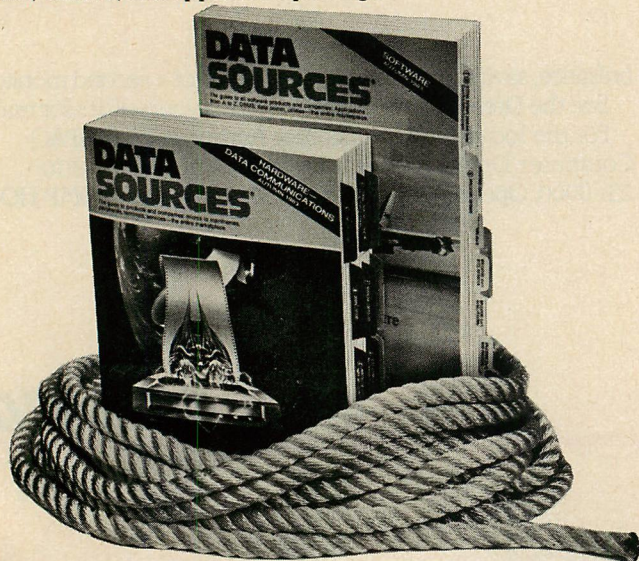
An information product of Ziff-Davis Publishing Company. Satisfaction guaranteed.

**SAVE TIME...CALL DIRECT 1-800-227-1617 EXT. 251**

Return coupon to: **DATA SOURCES** (In Ca., 1-800-772-3545 Ext. 251)

P.O. Box 845, Cherry Hill, N.J. 08034.

Residents of Ca., Co., Ct., D.C., Fl., Il., Ma., Mi., Mo., N.J., N.Y., Vt., please add applicable state taxes.





# Make Stat Magic

## Statistics, reports and plots happen magically with **SPSS/PC™—the Statistical Package for IBM PC/XTs.\***

SPSS/PC is the most comprehensive statistical package for performing simple or complex tasks, regardless of data size. It maintains feature and language compatibility with mainframe SPSS; while optimizing for the PC environment.

Statistics range from simple descriptive to complex multivariate, including Multiple Regression, ANOVA, Factor and Cluster analysis. Loglinear and nonparametric procedures are also included.

Simple facilities allow transfer of files between

SPSS/PC and programs like Lotus 1-2-3, dBase II and SAS. A complete Report Writer, Plotting facilities and a Communications program for mainframes round out a fully integrated product.

For more information, contact our Marketing Department without further ado. And see what a little stat magic can do for you.

SPSS Inc., 444 N. Michigan Avenue,  
Chicago, IL 60611, 312/329-2400.

In Europe: SPSS Benelux B.V.,  
P.O. Box 115, 4200 AC Gorinchem,  
The Netherlands, Phone: + 31183036711  
TWX: 21019.



**SPSS inc.** PRODUCTIVITY RAISED TO THE HIGHEST POWER™

\*SPSS/PC runs on the IBM PC/XT with 320K memory and a hard disk. An 8087 co-processor is recommended. Contact SPSS Inc. for other compatible computers.

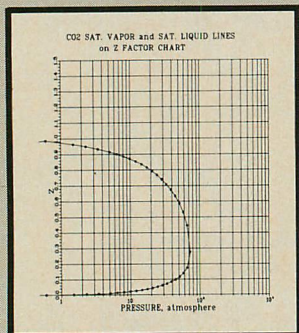
IBM PC/XT is a trademark of International Business Machines Corporation. dBase II is a trademark of Ashton-Tate. 1-2-3 is a trademark of Lotus Development Corporation. SAS is a trademark of SAS Institute, Inc. SPSS and SPSS/PC are trademarks of SPSS Inc. for its proprietary computer software.

© Copyright 1984, SPSS Inc.

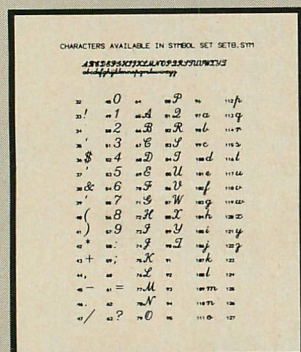
CIRCLE NO. 212 ON READER SERVICE CARD



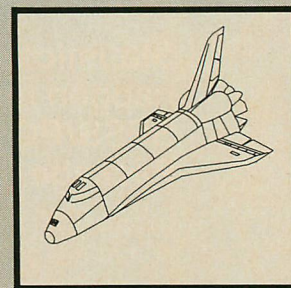
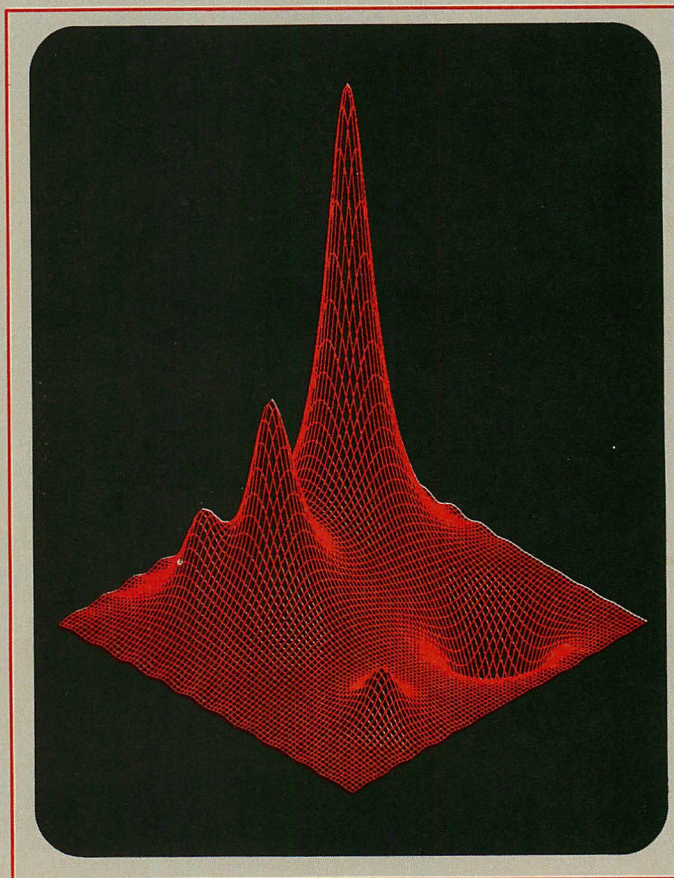
# CONVERT YOUR PRINTER INTO A DIGITAL PLOTTER



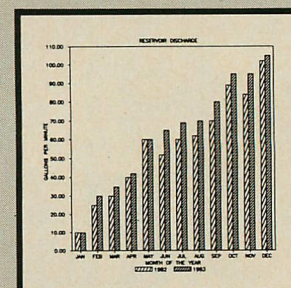
Scientific Plotting



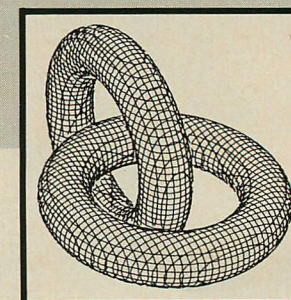
Symbol Sets



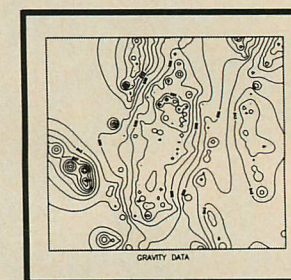
Digitizing



Business Graphics



Program Output



Contouring

**PLOTCALL** is a graphics system that processes standard plotter instructions into a form that can be printed on over 20 dot matrix printers. This is not another print screen program; presentation quality graphics are created directly on the printer to achieve the maximum resolution possible. (120 x 216 dots per inch for Epson printers)

**PLOTCALL** includes 17 symbol sets for sign making and plot labeling. Symbol sets may be altered, or create your own! Character strings may be created from any symbol set, rotated to any angle, and scaled to any size.

Plots can be created from any language or from digitized data. An interactive plot debugging program allows you to preview a plot on the screen before sending it to the printer.

All plots in this ad were created with **PLOTCALL** on an Epson printer. No ad-

ditional hardware is required, not even the color graphics card!

Also included are the following easy to use, interactive programs that utilize the **PLOTCALL** system:

**SURF** creates high resolution three dimensional surface plots with hidden line removal.

**TOPO** creates contour maps using the same data as **SURF**. **TOPO** uses the character routines in the **PLOTCALL** system to provide inline contour labels.

**GRAFIT** creates charts and graphs of all types - XY graphs, bar charts, pie charts, and line graphs.

IBM PC or compatible with a minimum of 128K of memory and a dot matrix printer with graphics option are required.

ENTIRE PACKAGE ONLY ..... \$199  
DEMO DISK (include printer model) ..... \$10

VISA AND MASTER  
CARD ACCEPTED

CIRCLE NO. 184 ON READER SERVICE CARD

To order or obtain further information, contact:

**GOLDEN SOFTWARE, P.O. Box 281, Golden, CO 80402 - (303) 279-1021**



# Basic Elegance

---

RON BAUMAN

*An annotated walkthrough of the program BASLDR that eases the process of calling subroutines from BASIC*

**T**hrough a rich command set, Microsoft's BASIC interpreter allows even novice programmers not only to implement traditional programs, but also to access almost all of the graphics, sound, and interface capabilities of the IBM PC. Quite naturally, PC add-on manufacturers want to provide the same ease of access to their products.

Unfortunately, the mechanism provided by Microsoft to integrate third-party software into the BASIC environment is crude and nearly impossible for any but experienced software developers to understand. Loading callable subroutines for use by BASIC, even when understood, is a tedious and error-prone process, hardly suitable for end users accustomed to user-friendly applications.

But there is a more elegant way. Loading BASIC-callable subroutines can be made fast, easy and, most importantly, transparent to the end user. Three of PC-DOS's most powerful capabilities—the EXEC function call, environments, and dynamic memory allocation—can be used to load a callable machine language subroutine image, then load and execute the BASIC interpreter itself. From the user's point of view, invoking this program is just the same as invoking the BASIC interpreter. The program takes any of the command line arguments that are accepted by BASIC. The subroutines are loaded in memory without any intervention on the part of the user.

---

*Ron Bauman is a consulting software engineer in the mini- and microcomputer industry. He is based in Ashland, MA.*



## BASIC ELEGANCE

Listing 1 is the assembly language program BASLDR, which loads the subroutine image and invokes BASIC on behalf of the user. BASLDR performs these tasks:

1. Releases its unneeded but allocated memory to DOS so there is room to load both the subroutine image and the BASIC interpreter;
2. Searches the current environment for an equivalence string that defines the location of the BASIC interpreter image to execute;
3. Determines the amount of memory that is needed to load the subroutine image and then allocates it via a DOS function call;
4. Loads the subroutine image via a DOS function call;
5. Stores the segment address of the loaded subroutine image where a BASIC program is able to read it;
6. Loads and executes the BASIC interpreter, passing the command line that is supplied by the user.

DOS passes control to BASLDR at location MAIN. There, the FAR return address of the PSP (Program Segment Prefix) is pushed on the stack. When the program finishes, it will perform a FAR RETurn, thus jumping to location 0 of the PSP, an INT 20H instruction (program terminate). The data segment is then established in DS.

At FILLBLK, the first steps are taken toward invoking the BASIC interpreter. The EXEC function call (4BH) requires a parameter block that describes the environment, command line, and default FCBs to be passed to the program to be invoked. Here the pointers to BASLDR's environment, command line, and FCBs are copied to the parameter block used to invoke the BASIC interpreter. The interpreter will inherit the same environment and command line arguments as BASLDR had on invocation. Appendix D of the *DOS Reference Manual* describes the EXEC function call.

DEALLMEM shows how to deallocate the memory not in BASLDR's code or data space. DOS's memory allocation mechanisms require some explanation.

### DOS MEMORY ALLOCATION

When a program is invoked, either from the command prompt or by an EXEC function call, DOS loads the program and allocates all available memory to it (see figure 1). All programs should deallocate memory they do not need. Programs *must* deallocate memory if they intend to use either the memory allocation/deallocation DOS function calls or the EXEC function. DOS will only

## The CALIFORNIA 10 PAK

A perfect set of 10 powerful software tools for IBM PC's and compatibles.



The CALIFORNIA 10 PAK, California Software Products, Inc.'s utilities package, is an indispensable tool for the advanced programmer. Made up of ten (actually we've included an eleventh as a bonus) software tools already loved by hundreds of users, CALIFORNIA 10 PAK is lauded by the critics . . .

"For all of the software written for the IBM pc, there is still a woeful shortage of utility programs. CALIFORNIA 10 PAK is a welcome addition, with its abilities to find all the differences between program versions or data files."

—SOFTALK, August 1983

"The advanced programmer will get a great deal of use out of all these utilities."

—PC TECH JOURNAL, December 1983

CALIFORNIA 10 PAK now supports color on the IBM PC, PC/XT, PC Jr and many compatibles.

Besides its ability to sort (on up to 5 fields), browse, compare files of data or text and

highlight differences, look at memory or disk, even disassemble programs, the 10 PAK now gives you the option of creating screens in vibrant color.

Order this acclaimed programmer's package today for only \$75.00 per CPU (plus \$3.00 shipping & handling, California residents add \$4.50 sales tax. VISA or M/C accepted).

**CALIFORNIA  
SOFTWARE  
PRODUCTS, INC.**

525 North Cabrillo Park Dr., Suite 300  
Santa Ana, California 92701  
(714) 973-0440, TLX 685645

IBM is a registered trademark of International Business Machines Corporation



allocate memory from its free memory pool. And it must allocate the memory required to load and execute a program.

The DOS function call 4AH (SETBLOCK) is used to modify the size of an allocated memory block. ES must contain the starting segment of the block and BX its new requested size in paragraphs (16-byte blocks). While not explicitly documented as such, the PSP segment of the program is the starting segment of the memory allocated to a program when it is loaded.

IBM, not well known for its software support, has some words of wisdom on setblock. To quote from its Customer Response #EF0014 and the DOS 2.1 *Technical Reference*, "A well-behaved program will use the SETBLOCK function to call when it receives control, to shrink its allocated memory block down to the size it really needs. . . ." Many programs are not "well-behaved," including IBM's.

Unlike the way it closes all open files, DOS does not deallocate memory that a program has allocated when exiting. The program must perform explicit deallocation or the memory will be unavailable to subsequent programs.

Adhering to the rules of memory allocation/deallocation will be crucial in the long-awaited DOS 3.0 multitasking environment. Unfortunately, the current documentation fails to prepare the way.

Two versions of BASIC may be invoked, and, under DOS version 2.0, they can reside in subdirectories. Rather than having the user supply the location of the BASIC.COM file at each invocation of BASLDR or force it to reside in the current directory, BASLDR finds the location of BASIC in the "environment." This approach also eliminates the need to parse the BASLDR command line.

DOS reserves an area of low memory aligned on a paragraph boundary for storage of "environ-

ment strings." These strings, which are terminated with a byte of binary zeros, can be used to pass information to processes. In theory, environments look like an interprocess communication mechanism. The implementation has some problems, however. The segment address of a program's environment can be found at offset 2CH in its PSP.

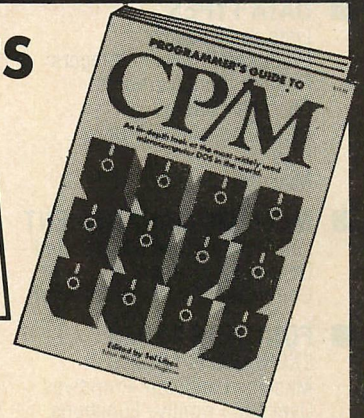
At location FINDSTR, BASLDR looks for a string in its environment of the following form:

**BASIC=dev:path\filespec**

Dev:path\filespec is the fully qualified location of the BASIC interpreter that the user wishes to invoke. The user specifies this equivalence string before invoking the

## PROGRAMMER'S GUIDE TO CP/M

EDITED BY SOL LIBES



Here's an important collection of CP/M insights that you'll never find in any CP/M manual. CP/M is the most popular microcomputer DOS in use today, and this widespread use has generated many innovative techniques and enhancements of CP/M. *Programmer's Guide to CP/M* tells you what these enhancements are and how to put them to use, how to get around apparent limitations of a CP/M system and why CP/M is far more versatile than you might have imagined. Every article in *Programmer's Guide to CP/M* originally appeared in MICROSYSTEMS between

January 1980 and February 1982. Except for this collection, these articles are now unavailable! *Programmer's Guide to CP/M* gives you an in-depth look at CP/M from the viewpoint of the programmer—the individual who creates the software that interfaces directly with CP/M, or who is installing CP/M on systems for which configurations do not already exist.

Contents include "An Introduction to CP/M," "The CP/M Connection," "CP/M Software Reviews," "CP/M Utilities & Enhancement," "CP/M 86" and "CP/M Software Directories." 200 pages, \$12.95.

### Microsystems

#### MICROSYSTEMS PRESS

Dept. NN8H 39 East Hanover Avenue  
Morris Plains, NJ 07950

Send me \_\_\_\_\_ copies of *Programmer's Guide to CP/M* at \$12.95 each, plus \$2 for postage and handling. #14C

☐ Outside USA add \$3.00 per order.

☐ PAYMENT ENCLOSED \$: \_\_\_\_\_ CA, NJ and NY State residents add applicable sales tax.

☐ CHARGE MY: ☐ American Express ☐ MasterCard ☐ Visa

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Signature \_\_\_\_\_

Print Name \_\_\_\_\_

Address \_\_\_\_\_ Apt. \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**For faster service, CALL TOLL FREE; 800-631-8112**  
(In NJ only, call 201-540-0445)



# LISP FOR THE IBM PERSONAL COMPUTER.

THE PREMIER LANGUAGE  
OF ARTIFICIAL  
INTELLIGENCE FOR  
YOUR IBM PC.

## ■ DATA TYPES

Lists and Symbols  
Unlimited Precision Integers  
Floating Point Numbers  
Character Strings  
Multidimensional Arrays  
Files  
Machine Language Code

## ■ MEMORY MANAGEMENT

Full Memory Space Supported  
Dynamic Allocation  
Compacting Garbage Collector

## ■ FUNCTION TYPES

EXPR/FEXPR/MACRO  
Machine Language Primitives  
Over 190 Primitive Functions

## ■ IO SUPPORT

Multiple Display Windows  
Cursor Control  
All Function Keys Supported  
Read and Splice Macros  
Disk Files

## ■ POWERFUL ERROR RECOVERY

## ■ 8087 SUPPORT

## ■ COLOR GRAPHICS

## ■ LISP LIBRARY

Structured Programming Macros  
Editor and Formatter  
Package Support  
Debugging Functions  
OBJ File Loader

## ■ RUNS UNDER PC-DOS 1.1 or 2.0

### IQLISP

5 1/4" Diskette  
and Manual \_\_\_\_\_ \$175.00  
Manual Only \_\_\_\_\_ \$ 30.00

 *Integral Quality*

P.O. Box 31970  
Seattle, Washington 98103-0070  
(206) 527-2918

Washington State residents add sales tax.  
VISA and MASTERCARD accepted.  
Shipping included for prepaid orders.

## BASIC ELEGANCE

BASLDR program with the following command:

**SET BASIC=dev:path\filespec**

This can be conveniently done in the AUTOEXEC.BAT file.

If the BASIC equivalence string cannot be found in the environment, BASLDR will try to locate BASICA.COM, then BASIC.COM in the current directory (location SDONE). The first of these that is found becomes the BASIC that will be loaded and executed.

The next step is to determine the amount of memory needed to load the subroutine image. Because the subroutine image is loaded as an overlay to BASLDR, the memory must already be allocated for it by BASLDR. At location READHDR, the .EXE file of the subroutines is opened and the file header read.

Appendix H of the DOS *Reference Manual* describes .EXE file structure and how a program is loaded. The size of the file in pages (512-byte blocks) is at offset 4 from the beginning of the header. While the size of the load module itself can be calculated exactly, it's easier to request a size equal to the file size in pages plus one. (The file size includes the header.)

### EXEC FUNCTION CALL

At this point, the EXEC function call can be invoked to cause the subroutine image to be loaded as an overlay (see figure 1). The DOS EXEC function call (4BH) allows a program to invoke another program. This process, called *spawning*, is powerful" and quite easy.

The parent (invoking) process can specify the environment, command line, and two FCBs to the child (invoked) process by means of a parameter block. Once the EXEC function is called, DOS will allocate memory, load, and pass control to the child process just as if it had been invoked from the command prompt. When the child process exits, control is returned to the

statement in the parent process following the EXEC function call.

The EXEC function call can also be used to load an overlay on behalf of a program. Again, a parameter block must be supplied to the function call. In this case, the segment location where the overlay is to be loaded and the segment fix-up value must be supplied in the parameter block. This simplifies using overlays, since the overlay's segment references are automatically adjusted by DOS to the values in the parameter block.

When a child process receives control, it does not receive a pointer to the parent's environment, but rather to a *copy* of the parent's environment. Thus, any changes that the child process might make to its environment will not be found by the parent process or by any other process spawned with the same environment address.

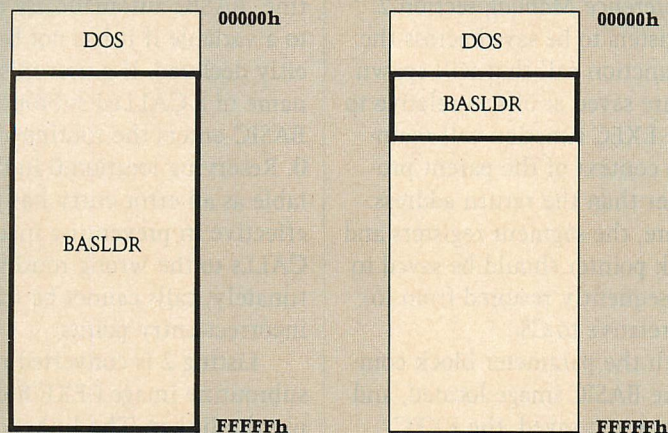
The environment must be contiguous. This causes some problems, even for DOS, which allocates only a small area of memory for the environment under version 2.0. It's quite easy to encounter an "out of environment space" while issuing SET commands if memory-resident routines have been loaded. The only recourse is to reboot, then issue the SET commands before loading any memory-resident routines.

In BASLDR at location LOADSUB, both the starting segment to load the subroutine image and the segment fix-up value are made the same as the starting segment of the memory block just allocated for the subroutine image. The EXEC function is then called to load the subroutine image file as an overlay.

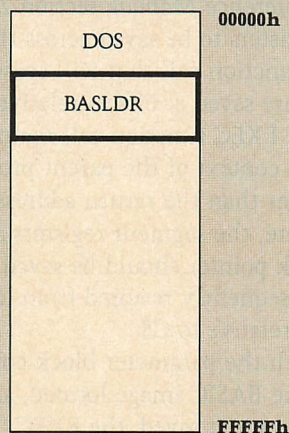
For the user's BASIC program to call the subroutines, it will need to specify the segment where they reside via a DEF SEG statement. BASLDR places the segment address in the last two bytes of the "interapplication communications area" beginning at 0:4FE (location SAVSEG). This block of memory is mentioned



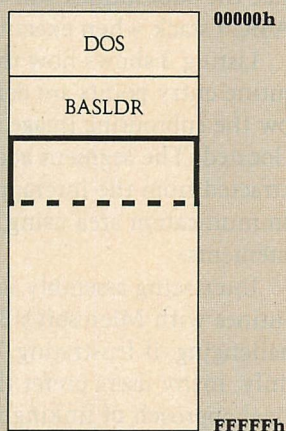
Figure 1: Memory Allocation during BASLDR Execution



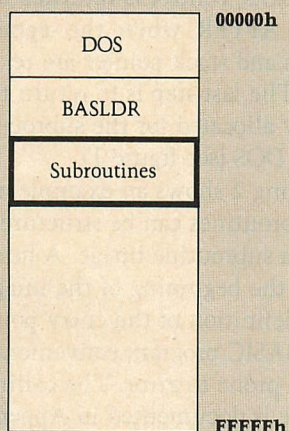
DOS loads BASLDR, allocating all of memory to it.



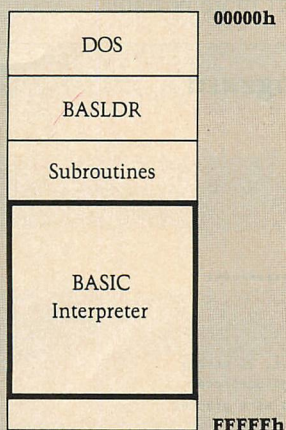
BASLDR deallocates memory above itself via function call 4AH.



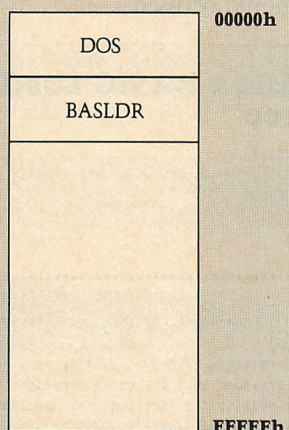
BASLDR determines memory needed to load the subroutine's .EXE file and allocates it via function call 48H.



BASLDR requests DOS to load subroutines as an overlay via function call 4BH.



BASLDR requests DOS to execute the BASIC Interpreter via function call 4BH. The interpreter receives control. The user is in BASIC.



When BASIC exits, BASLDR receives control. BASLDR deallocates the memory used by the subroutines, then exits, returning control to DOS.

## My Programs Always Compile the *FirstTime*™

**Yours can too!**

*FirstTime* is an intelligent editor that knows the rules of the language being programmed. It checks your statements as you enter them, and if it spots a mistake, it identifies it. *FirstTime* then positions the cursor over the error so you can correct it easily. *FirstTime* will identify all syntax errors, undefined variables, and even statements with mismatched variable types. In fact, any program developed with the *FirstTime* editor will compile on the first try.

### Unprecedented

*FirstTime* has many unique features found in no other editor. These powerful capabilities include a zoom command that allows you to examine the structure of your program, automatic program formatting, and block transforms.

If you wish, you can work even faster by automatically generating program structures with a single key-stroke. This feature is especially useful to those learning a new language, or to those who often switch between different languages.

**Other Features:** Full screen editing, horizontal scrolling, function keys labeled on screen, help screens, inserts, deletes, appends, searches, and global replacing.

Programmers enjoy using *FirstTime*, because its powerful features allow them to concentrate on the program logic without having to worry about coding details. Debugging is reduced dramatically, and deadlines are more easily met.

The *Spruce FirstTime* editor is immediately available for PASCAL (\$245) and C (\$295) on the IBM Personal Computer and its compatibles. A demonstration disk is available for \$25. (N.J. residents please add 6% sales tax.)

For programs that compile the *FirstTime*.

To order, call or send check to:

**Spruce**  
Technology Corporation  
110 Whispering Pines Drive  
Lincroft, N.J. 07738  
(201) 741-8188 or (201) 663-0063

Dealer enquiries welcome. Custom versions for computer manufacturers and language developers are available.

*FirstTime* is a trademark of Spruce Technology Corporation.



CIRCLE NO. 132 ON READER SERVICE CARD



# FAST LETTER QUALITY FOR YOUR EPSON

Now you can print **letter quality** on your Epson FX printer at **full text-mode speed**, up to 10 times faster than with programs using graphics mode. **Printer Boss™** software gives you **two-pass dot-matrix letter quality** and lets you create a **printer buffer** of up to 32K. Or print multi-page **spreadsheets** as wide as you like, **sideways** on your paper, at high speed, in a choice of five different type sizes.

**Printer Boss™** also allows full menu-based operation of all control functions of all of the Epson MX, FX and RX printers. **Select** and de-select pica, elite, compressed, italic, enlarged, emphasized, doublestrike, underline, superscript and subscript for scores of different faces. **Set** line spacing, right and left margins and skip-over-perforation. **Load** USA, France, Germany, England, Denmark, Sweden, Italy, Spain and Japan language sets. **Control** unidirectional, half-speed and proportionally-spaced printing. **Store and retrieve** 10 complete menu settings with a few keystrokes. **Emulate** the IBM-label printer for the IBM-PC while retaining full printer versatility. **Download** to FX printers five different **IBM character sets**, including graphics symbols, greek symbols, screen and APL characters. Print at full text-mode speed. Ideal for **IBM graphics** software, or **screen dumps**, or printing text from **Wordstar, Lotus 123** or many other fine programs.

**Printer Boss™** for the IBM-PC and compatibles \$59.95. With Letter Boss™ letter quality or Sidekick™ sideways print option \$99.95. With both \$139.95. Visa, MC, or send check. Free info. Dealers welcome.

## Printer Boss™

CONNECTICUT SOFTWARE  
30 WILSON AVENUE  
ROWAYTON CT 06853  
203-838-1844

SIDEKICK IS NOT TO BE CONFUSED WITH SIDEWAYS. A TRADEMARK OF FUNK SOFTWARE. PRINTER BOSS, LETTER BOSS AND SIDEKICK ARE TRADEMARKS OF SPEER RESEARCH CORPORATION. WORDSTAR AND LOTUS 123 ARE TRADEMARKS OF MICROPRO INT'L CORP AND LOTUS DEVELOPMENT CORP RESPECTIVELY.

## BASIC ELEGANCE

only in the table entitled "Reserved Memory Locations" in the *PC Technical Reference Manual*, section 2.

Registers to be saved across the EXEC function call that will spawn BASIC are saved at offsets relative to CS. The EXEC function call maintains no context of the parent process other than the return address. Therefore, the segment registers and the stack pointer should be saved to and subsequently restored from locations relative to CS.

With the parameter block complete, the BASIC image located, and critical context saved, the EXEC function call is made to spawn BASIC (location SPAWN). When BASIC exits, control is returned to location AFTER, where the segment registers and stack pointer are restored. The last step is to return the memory allocated for the subroutines to DOS (see figure 1).

Listing 2 shows an example of how subroutines can be structured within a subroutine image. A jump table at the beginning of the image makes definition of the entry points in the BASIC program convenient and less prone to error. The calling interface is documented in Appendix C of the *BASIC Reference Manual*. Note that this table uses NEAR jumps. If the subroutines require more than 64K bytes in total, FAR jumps should be used.

The entry at offset 0 in the jump table points to an error routine. BASIC automatically assigns 0 to a variable if it has not been explicitly declared. If a user mistypes the name of a CALLED subroutine, BASIC enters the routine at location 0. Reserving location 0 in the jump table as an error entry has proved effective in preventing inadvertent CALLs to the wrong routine. Unfortunately, calls cannot be trapped to incorrect entry points.

Listing 2 is converted into a subroutine image (.EXE file) by using the linker. The linker, however, will issue the error message "no stack segment." This can be ignored since the subroutines will use BASIC's stack when executing.

Listing 3 shows how the subroutine entry points are defined and how the subroutine image segment is located. The segment address is extracted from the interapplications communication area using PEEK statements.

Interfacing assembly language routines with Microsoft's BASIC is a challenging, if frustrating, job. Certainly, many users prefer the traditional approach of linking subroutines into an executable image rather than coping with the idiosyncrasies of BASIC. The techniques presented here may make the latter effort more bearable.

### Listing 1 BASIC Loader Program Source

```
PAGE 58,132
TITLE BASLDR -- Interpreted BASIC loader program
NAME BASLDR
```

```
COMMENT $
```

```
*****
```

```
COPYRIGHT (C) 1984, DATA TRANSLATION, INC.
```

```
General permission to copy or modify, but not for profit, is hereby
granted, provided that the above copyright notice is included and
reference made to the fact that reproduction privileges were granted
by Data Translation, Inc.
```

```
Neither the author nor Data Translation, Inc. assume any
responsibility for the use or reliability of the described software.
```

```
*****
```

```
BASLDR is invoked by a user in lieu of BASIC when using callable
```



assembly language routines. BASLDR performs the following functions:

- deallocates memory above itself for loading the routines and BASIC.
- scans the environment table for the SET string associated with BASIC= to find the location of the BASIC .COM image. If not found, attempts to use BASICA.COM in current directory. If not found, attempts to use BASIC.COM in the current directory.
- loads the callable subroutines image using the EXEC overlay DOS function.
- stores the segment of the routines in the interapplication communications area at 0:4FE, 0:4FF. The BASIC user can determine the DEF SEG of the subroutines by doing a PEEK at these locations.
- spawns the BASIC specified above with the command line supplied by the user.

Note that any redirection of standard input and output is also passed on to the spawned BASIC. This occurs transparently to BASLDR.

To create the executable image:

```
MASM BASLDR,BASLDR,BASLDR;
LINK BASLDR,;
```

Written 3/19/84 by Ron Bauman

```

;
; Define the code, data and stack segments and groups.
;
PGROUP GROUP PROG
DGROUP GROUP DATA,STACK

PROG SEGMENT BYTE PUBLIC 'CODE'
PROG ENDS

DATA SEGMENT WORD PUBLIC 'DATA'
;
;_TOP DW 0 ;top of the stack address storage
;
;COMMLOC EQU 4FEH ;interapplications comm area in low
; ;memory where segment of subroutine
; ;image is stored
; ;storage for BASIC interpreter
; ;filespec
; ;offset of BASIC filename string
; ;name of callable subroutines image
;
;ENVSTR DB 'BASIC=' ;SET string in environment to be
; ;matched
; ;length of SET string for search
;
;ADVBASE DB 'BASICA.COM',0 ;advanced BASIC filespec
; ;disk BASIC filespec
;
;HORSIZ EQU 32 ;size of .exe file header to read in
; ;bytes
;
;EXEHDR DB HORSIZ DUP (0) ;buffer to contain MYSUBS.EXE image
; ;header
; ;offset to .exe image size in .exe
; ;header
;
; ;PSP offset definitions
;
;ENVIR EQU 2CH ;segment address of passed
; ;environment
;
;CMDLEN EQU 80H ;size of string on command line
;
;CMD EQU 81H ;address of string passed on
; ;command line
;
;FCB1 EQU 5CH ;first default FCB
;
;FCB2 EQU 6CH ;second default FCB
;
; ;subroutine image loader parameter block
;
;SBLOCK DW 2 DUP (0)
;
;SBSEG EQU 0 ;offset to segment address to load
; ;image
;
;SBREL EQU 2 ;offset to word relocation factor
;
; ;BASIC image loader parameter block
```

```

;
;BBLOCK DW 7 DUP (0) ;define offsets in BBLOCK
;
;BENV EQU 0 ;segment address of environment
;
;BBCMDP EQU 2 ;DWORD of command line to be passed
;
;BBFCB1 EQU 6 ;DWORD of first FCB
;
;BBFCB2 EQU 10 ;DWORD of second FCB
;
; ;error message strings
;
;LEADR DB 'BASLDR -- '$
;
;NOTFMSG DB 'File MYSUBS.EXE was not found in the current directory.'
;DB 13,10,'$'
;
;NORMMSG DB 'Not enough memory to load MYSUBS.EXE.',13,10,'$'
;
;NOBMSG DB 'BASIC program was not found.',13,10,'$'
;
;DATA ENDS

STACK SEGMENT PARA STACK 'DATA'
SBASE DW 8*16 DUP (?) ;keep size a multiple of 16
STKEND EQU $ ;end of stack
STACK ENDS

PROG SEGMENT BYTE PUBLIC 'CODE' ;begin code
ASSUME CS:PGROUP
;
;
;MAIN PROC FAR
;
;PUSH DS ;save the PSP address for return
;
;XOR AX,AX ;and the offset
;
;PUSH AX
;
;MOV AX,DGROUP ;set up DS register to address our
; ;data segment
;
;MOV DS,AX
;
;ASSUME DS:DGROUP
;
; ;fill the BASIC loader parameter block from our PSP while we have the
; ;PSP address in ES.
;
;FILLBLK:
;
;MOV BX,OFFSET BBLOCK ;get parameter block address in BX
;
;MOV AX,ES:ENVIR ;load environment segment
;
;MOV BBENV[BX],AX
;
;MOV WORD PTR BBCMDP[BX],CMDLEN ;load the command line pointer
;
;MOV BBCMDP+2[BX],ES
;
;MOV WORD PTR BBFCB1[BX],FCB1 ;load FCB1 pointer
;
;MOV BBFCB1+2[BX],ES
;
;MOV WORD PTR BBFCB2[BX],FCB2 ;load FCB2 pointer
;
;MOV BBFCB2+2[BX],ES
;
; ;
; ;deallocate memory above our stack for the subroutines and interpreter
;
;DEALLMEM:
;
;MOV AX,OFFSET STKEND ;get the end of the stack
;
;MOV _TOP,AX ;save it
;
;MOV CL,4 ;make it a paragraph value
;
;SHR AX,CL
;
;MOV BX,SS ;get the stack segment
;
;ADD BX,AX ;end of program in paras.
;
;MOV AX,ES ;start of PSP and memory to
; ;deallocate
;
;SUB BX,AX ;final requested size of memory
;
;MOV AH,4AH ;SETBLOCK DOS function request
;
;INT 21H
;
; ;
; ;extract the location of the BASIC program we are to invoke. First
; ;we scan the environment for a string equated to "BASIC=".
;
;FINDSTR:
;
;MOV AX,BBLOCK+BENV ;get the environment seg address in ES
;
;MOV ES,AX
;
; ;
;
;XOR DI,DI ;ES:DI points to start of environment
;
;CLD ;forward string comparison
;
; ;
;
;SCNENV:
;
;CMP BYTE PTR ES:[DI],0 ;zero byte is end of environment
;
;JZ SDOONE
```



# BASIC ELEGANCE

```

MOV     SI,OFFSET ENVSTR      ;DS:SI points to string to find
MOV     CX,ESTRLEN           ;length of comparison
REPE    CMPSB                ;compare until a mismatch
OR      CX,CX                ;did the SET string match completely?
JZ      FOUND
XOR     AL,AL                ;skip to end of this environment string
SAGAIN: SCASB
JNE     SAGAIN
JMP     SHORT SCENV
;
;
; here for BASIC found. ES:DI points to BASIC file string. copy it to
; our area for the spawn call.
;
FOUND:
MOV     SI,OFFSET BASFIL
SMOV:   MOV     AL,ES:[DI]
        MOV     [SI],AL
        INC     SI
        INC     DI
        OR      AL,AL
        JNZ     SMOV
;
        MOV     DX,OFFSET BASFIL
        MOV     AH,3DH        ;try to open it
        XOR     AL,AL        ;for read
        INT     21H
        JNC     BASFND
;
; here for no environment equivalence. Try to open the advanced then
; disk BASIC images.
;
SOONE:
MOV     DX,OFFSET ADVBAS
        ;name of BASIC image.
        XOR     AL,AL        ;request a read on open
        MOV     AH,3DH        ;open file DOS function
        INT     21H
        JNC     BASFND
;
        MOV     DX,OFFSET DSKBAS
        ;name of BASIC image.
        XOR     AL,AL        ;request a read on open
        MOV     AH,3DH        ;open file DOS function
        INT     21H
        JNC     BASFND
;
        JMP     NOBASIC      ;error, goto file not found.
;
BASFND:
MOV     STRLOC,DX            ;save offset to file string for later
                                ;invocation
MOV     BX,AX
MOV     AH,3EH              ;close the BASIC we have opened.
INT     21H
;
; open the subroutine image file to get it's size for allocation and
; loading
;
OPNSUB:
MOV     DX,OFFSET SUBNAM
        ;name of subroutine image.
        XOR     AL,AL        ;request a read on open
        MOV     AH,3DH        ;open file DOS function
        INT     21H
        JNC     READHDR
        JMP     FNOTFND      ;error, goto file not found.
;
; Read the header created by the linker to get the image size
;
READHDR:
MOV     BX,AX                ;file handle to BX
MOV     CX,HDRSIZ           ;size of header area
MOV     DX,OFFSET EXEHDR
                                ;address of buffer to hold header
MOV     AH,3FH              ;read the header.
INT     21H
;
; close the file
;
MOV     AH,3EH
INT     21H

```

```

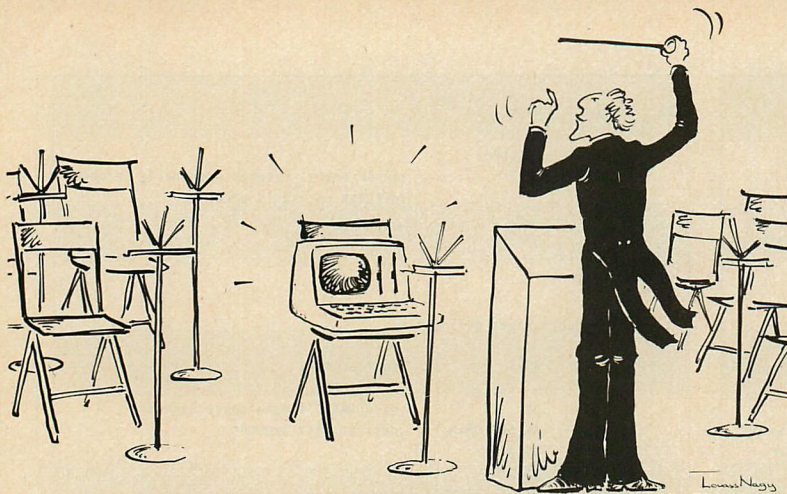
; get the image size (in 512-byte pages) and convert to paragraphs
;
CALCSIZ:
    MOV     BX,WORD PTR EXEHDR+IMGSIZ
    INC     BX                ;add extra page to ensure remainder
                                ;will fit
    MOV     CL,5
    SAL     BX,CL            ;multiply by 32
;
; request that much memory for loading the subroutine image and invoke
; the load.
;
    MOV     AH,4BH          ;allocate memory function
    INT     21H
    JNC     LOADSUB
    JMP     NORDOOM          ;memory allocation failure
LOADSUB:
    MOV     SBLOCK+SBSEG,AX ;segment load address of subroutine
                                ;image
    MOV     SBLOCK+SBREL,AX ;also the segment fixup value
;
    MOV     DX,OFFSET SUBNAM
    MOV     AX,DS
    MOV     ES,AX            ;set up pointer to param block
    ASSUME ES:DGROUP
    MOV     BX,OFFSET SBLOCK
    MOV     AL,3             ;overlay load
    MOV     AH,4BH          ;EXEC function call
    INT     21H
;
; store the segment of the image in the interapplication
; communications area
;
SAVSEG:
    XOR     AX,AX            ;segment 0
    MOV     ES,AX
    MOV     AX,SBLOCK+SBSEG ;get the segment where the subs were
                                ;loaded
    MOV     ES:COMMLOC,AX    ;save it in the area
;
; set up the parameters for the EXEC function call.
;
BPSET:
    MOV     AX,DS            ; get address of param block in ES:BX
    MOV     ES,AX
    ASSUME ES:DGROUP
    MOV     BX,OFFSET BBLOCK
    MOV     DX,STRLOC
                                ; get address of file to execute
                                ; in DS:DX
;
; ready to spawn the interpreter. Save the necessary registers.
;
SPAWN:
    MOV     CS:SSSAV,SS
    MOV     CS:SPSAV,SP
    MOV     CS:BPSAV,BP
    MOV     CS:DSSAV,DS
;
    MOV     AL,0             ;load and execute function
    MOV     AH,4BH          ;EXEC function
    INT     21H
;
AFTER:
    MOV     BX,CS:SSSAV      ;RESTORE REGS
    MOV     SS,BX
    MOV     BX,CS:SPSAV
    MOV     SP,BX
    MOV     BX,CS:BPSAV
    MOV     BP,BX
    MOV     BX,CS:DSSAV
    MOV     DS,BX
;
; deallocate the memory used for the subroutines
;
RETMEM:
    MOV     AX,SBLOCK+SBSEG ;get segment from param block
    MOV     ES,AX
    MOV     AH,49H          ;FREE ALLOCATED MEMORY function
    INT     21H
;
    RET                     ; all done

```









## Cross-Assemblers to Beat the Band!

### Development Tools That Work

Avocet cross-assemblers are fast, reliable and user-proven in over 4 years of actual use. Ask NASA, IBM, Xerox or the hundreds of other organizations that use them. Every time you see a new micro-processor-based product, there's a good chance it was developed with Avocet cross-assemblers.

Avocet cross-assemblers are easy to use. They run on almost any personal computer and process assembly language for the most popular microprocessor families.

### Your Computer Can Be A Complete Development System

Avocet has the tools you need to enter and assemble your software and finally cast it in EPROM:

**VEDIT Text Editor** makes source code entry a snap. Full-screen editing plus a TECO-like command mode for advanced tasks. Easy installation - INSTALL program supports over 40 terminals and personal computers. Customizable keyboard layout. CP/M-80, CP/M-86, MSDOS, PC DOS . . . . . \$150

**EPROM Programmers** let you program, verify, compare, read, display EPROMS but cost less because they communicate through your personal computer or terminal. No personality modules! On-board intelligence provides menu-based setup for 34 different EPROMS, EEPROMS and MPUs (40-pin devices require socket adaptors). Self-contained unit with internal power supply, RS-232 interface, Textool ZIF socket. Driver software (sold separately) gives you access to all programmer features through your computer, lets you download cross-assembler output files, copy EPROM to disk.

**Model 7228 Advanced Programmer** — Supports all PROM types listed. Superfast "adaptive" programming algorithm programs 2764 in 1.1 minutes.

**Model 7128 Standard Programmer** — Lower-cost version of 7228. Supports all PROM types except "A" versions of 2764 and 27128. Standard programming algorithm programs 2764 in 6.8 minutes.

Avocet Cross-assembler	Target Microprocessor	CP/M-80	CP/M-86 IBM PC, MSDOS**
XASM04 NEW	6804	\$ 250.00	\$ 250.00
XASM05	6805	200.00	250.00
XASM09	6809	200.00	250.00
XASM18	1802/1805	200.00	250.00
XASM48	8048/8041	200.00	250.00
XASM51	8051	200.00	250.00
XASM65	6502/65C02	200.00	250.00
XASM68	6800/01, 6301	200.00	250.00
XASM75	NEC 7500	500.00	500.00
XASM85	8085	250.00	250.00
XASM400	COP400	300.00	300.00
XASMF8	F8/3870	300.00	300.00
XASMZ8	Z8	200.00	250.00
XASMZ80	Z80	250.00	250.00
XMAC682 NEW	68200	595.00	595.00
XMAC68K NEW	68000/68010	595.00	595.00

**Model 7956 and 7956-SA Gang Programmers** — Similar features to 7228, but program as many as 8 EPROMS at once. 7956-SA stand-alone version copies from a master EPROM. 7956 lab version has all features of stand-alone plus RS-232 interface.

**EPROM:** 2758, 2716, 2732, 2732A, 2764, 2764A, 27128, 27128A, 27256, 2508, 2516, 2532, 2564, 68764, 68766, 5133, 5143. **CMOS:** 27C16, 27C32, 27C64, MC6716. **EEPROM:** 5213, X2816A, 48016, I2816A, 5213H. **MPU (w/adaptor):** 8748, 8748H, 8749, 8749H, 8741, 8742, 8751, 8755.

7228	Advanced Programmer	\$ 549
7128	Standard Programmer	429
7956	Laboratory Gang Programmer	1099
7956-SA	Stand-Alone Gang Programmer	879
PDV	Driver Software	95
481	8748 Family Socket Adaptor	98
511	8751 Socket Adaptor	174
755	8755 Socket Adaptor	135
CABLE	RS-232 Cable (specify gender)	30

**HEXTRAN Universal HEX File Converter** — Convert assembler output to other formats for downloading to development systems and target boards. Also useful for examining object file, changing load addresses, extracting parts of files. Converts to and from Intel, Motorola, MOS, RCA, Fairchild, Tektronix, TI, Binary and HEX/ASCII Dump formats. For CP/M, CP/M-86, MSDOS, PC DOS . . . . . \$250

Ask about UNIX.

Would you hire an entire band when all you need is one instrument? Of course not.

So why use a whole orchestra of computers when all you need is one to develop software for virtually any type of micro-processor?

The secret? Avocet's family of cross-assemblers. With Avocet cross-assemblers you can develop software for practically every kind of processor — *without having to switch to another development system along the way!*

**AVOCET'S SUPERB 68000 CROSS-ASSEMBLER** — With exhaustive field testing completed, our 68000 assembler is available for immediate shipment. XMAC68K supports Motorola standard assembly language for the 68000 and 68010. Macros, cross-reference, structured assembly statements, instruction optimization and more. Linker and librarian included. Comprehensive, well-written manual. XMAC682 for MK68200 has similar features.

Call us toll-free for some straight talk about development systems.

**1-800-448-8500**

(in the U.S. Except Alaska and Hawaii)

VISA and Mastercard accepted. All popular disc formats now available — please specify. Prices do not include shipping and handling — call for exact quotes. OEM INQUIRIES INVITED.

\*Trademark of Digital Research \*\*Trademark of Microsoft

**AVOCET SYSTEMS INC.™**

DEPT.  
804 SOUTH STATE STREET  
DOVER, DELAWARE 19901  
302-734-0151 TELEX 467210



THE WORLD'S MOST POPULAR

# UNIX SYSTEM

FOR THE

## IBM PC

AND

## LISA 2

Now, SCO brings the world's most popular version of AT&T's UNIX™ Operating System — and a comprehensive line of applications software — to the IBM® Personal Computer and the Apple® Lisa® 2. XENIX™ from SCO is simply the best microprocessor-based UNIX you can buy. **No one else in the UNIX business provides you with better support, and no other version of UNIX gives you all these features:**

### VISUAL SHELL:

The XENIX visual shell provides you with a screen-oriented, menu-driven interface—with selectable color for the IBM PC.

### MULTIUSER:

With XENIX, 3 or more users may efficiently use a single IBM PC or Lisa 2 simultaneously.

### MOST APPLICATIONS:

With nearly 80% of all micro-based UNIX systems running XENIX, more applications are available for XENIX than for any other version of UNIX.

### MULTISCREEN™:

SCO's Multiscreen™ allows you to run multiple programs simultaneously and view each program's screen with a touch of a key.

### MOST COMPLETE:

XENIX is the most complete version of the UNIX System available for micros — including Microsoft's commercial enhancements and key extras from Berkeley 4.2 UNIX.

### MICNET:

Micnet local area networking doesn't require a systems programmer to set up or added hardware to run.

### PC-DOS:

XENIX lets you read and write PC-DOS files on the IBM PC—and a cross-development environment will be available soon.

### DOCUMENTATION:

SCO's XENIX documentation is written to meet the needs of the small systems marketplace — well-organized, clear, concise.

The powerful family of XENIX systems software and applications is available today from SCO — your UNIX Systems Software Company since 1978 — to set a new standard for personal computer productivity.



YOUR UNIX SYSTEMS SOFTWARE COMPANY

500 CHESTNUT STREET  
P.O. BOX 1900  
SANTA CRUZ, CALIFORNIA 95061

# 408/425-7222

Let's go to work.

UNIX is a trademark of Bell Laboratories.  
IBM is a registered trademark of International Business Machines Corp.  
Apple and Lisa are registered trademarks of Apple Computer, Inc.  
XENIX is a trademark of Microsoft Corp.  
Multiscreen is a trademark of The Santa Cruz Operation, Inc.  
© 1984 The Santa Cruz Operation, Inc.

CIRCLE NO. 191 ON READER SERVICE CARD



# The Pascal for Serious Software Developers

## IBM® PC-8086 Professional Pascal™

### The Language

- Full ANSI standard base language
- Rich set of flexible extensions including
  - Separate compilation with packages from Ada
  - Low-level, machine dependent support from C
  - Varying length strings and additional useful data types
  - Communication with other languages
  - Three precisions of integer and floating arithmetic
  - Extensive set of run-time library utility packages

### The Compiler

- High capacity, high performance, resident and cross compilers
  - 8088/8086/80186/80286
  - Instructions for 80186 and 80286
  - Compiler and programs operate in full 80286 memory management mode
  - Emits 8087 native code or software emulation
- Full range of support extending to very large, complex applications
- Five memory models: small, compact, medium, big, and large
- High reliability — constructed using state-of-the-art syntactic analysis technology
- Sophisticated user error reporting and recovery
  - More than 200 distinct error and warning diagnostics
  - Source code line and column pinpointed
- Produces ROMable code for embedded applications
- Excellent code optimization for both space and speed

### Enhanced Productivity

- Faster application development
  - Enhanced Pascal type protection — with optional override — detects more bugs earlier
  - "Loopholes" package permits skirting Pascal type checking so that you can "get the job done"
- Easier development and management of large programs due to separate compilation, packages, and the absence of compiler limitations
- Reduced complexity of machine-specific software afforded by C-like features

### Enhanced Bottom Line

Protection of your investment in existing software by allowing communication with other languages such as C and PL/M. Truly compiled software products that are compact, efficient, and fast. Language portability across a range of micros, minis, and mainframes. Responsive, comprehensive support from a company with a decade of providing software tools to professionals and a commitment to excellence.

Professional Pascal is a trademark of Metaware Incorporated, Santa Cruz, CA. MICROTEC is a trademark of Microtec Research, Inc., Santa Clara, CA.

If you are a computer manufacturer, systems house, or other serious software developer, PROFESSIONAL PASCAL is THE Pascal for you.



**MICROTEC™  
RESEARCH**

3930 Freedom Circle, Santa Clara, CA 95054, (408) 733-2919 • Telex (ITT) 4990808

CIRCLE NO. 143 ON READER SERVICE CARD



# BASIC String Manipulation

TECH  
NOTEBOOK  
26

*Undocumented techniques for working with strings on the IBM PC*

DAN ROLLINS

In addition to the standard string-manipulation functions described in the BASIC manual, several other techniques are available.

## Garbage Collection

Programs sometimes stall while BASIC reorganizes its limited string space. Garbage-collection time can be minimized by defining fewer strings—especially by dimensioning string arrays with a smaller number of elements. When a string array is no longer needed, use the ERASE command. BASIC will have fewer strings to reorganize, so the reorganization will go faster.

In a program that has a particularly critical period during which the garbage collector must not come into action, the FRE("\$") command can be used to force garbage collection to occur.

Here is a trick that will minimize the number of times that garbage collection occurs: use the SWAP command to avoid assigning a temporary variable. For example, a string sort can be shortened dramatically by replacing

```
T$=A$(J):A$(J)=A$(J+1)
:A$(J+1)=T$
```

with

```
SWAP A$(J), A$(J+1)
```

## Padding and Truncating

Programmers often write code to pad an input field with blanks. To create a 12-digit, right-justified

numeric string from the value of the variable N, try using this:

```
N$=STR$(N)
:N$=SPACES(12-LEN(N$))+N$
```

Here's an alternative method:

```
N$=RIGHT$(SPACES(12)+STR$(N),12)
```

This example creates a temporary string that is at least 13 characters long with leading spaces, then chops off all but the final 12 characters.

A similar technique can be used to pad an alphabetic string with trailing spaces. The following example will left-justify L.NAME\$ in a field of NAME.LEN blanks:

```
L.NAME$=LEFT$(L.NAME$+
SPACES(NAME.LEN),
NAME.LEN)
```

This technique also truncates L.NAME\$ to the desired length if it happens to be too long.

Although the RIGHT\$ function is quite useful, it can be awkward in some cases. For instance, to extract a sub-string that starts at position P in string A\$, the following code could be used:

```
$$=RIGHT$(A$,LEN(A$)-P)
```

This causes an illegal function error, however, if P is greater than the length of A\$. The MID\$ function offers an elegant solution. After

```
$$=MID$(A$,P)
```

\$\$ will contain the characters starting from position P of A\$. If A\$ has

fewer than P characters, then \$\$ will be equal to "" (the null string).

## Upshifting

Only the most unfriendly programs ignore lower-case input. Unfortunately, BASIC has no intrinsic UP-SHIFT\$ function, but it is not difficult to build such a function into a subroutine. The following subroutine will force all characters in A\$ into upper-case:

```
100 FOR J=1 TO LEN(A$)
110 C=ASC(MID$(A$,J,1))
120 IF C >= 97 AND C <= 122
    THEN MID$(A$,J,1)=
        CHR$(C-32)
130 NEXT J:RETURN
```

This routine first converts the current character into a number, avoiding repeated calls to the BASIC string comparison routine (97 and 122 are the ASCII values of *a* and *z*, respectively, and 32 is the difference between *A* and *a*). This routine is most efficient when C and J have been declared as integers—the speed increase is quite noticeable in compiled BASIC programs. Notice, too, that no new string is created during the subroutine (the upshifted characters of A\$ are placed back into A\$ via the MID\$= assignment statement), so garbage collection is never triggered.

These techniques will make programming in BASIC easier.



*Dan Rollins is a software consultant and freelance writer who lives in California.*

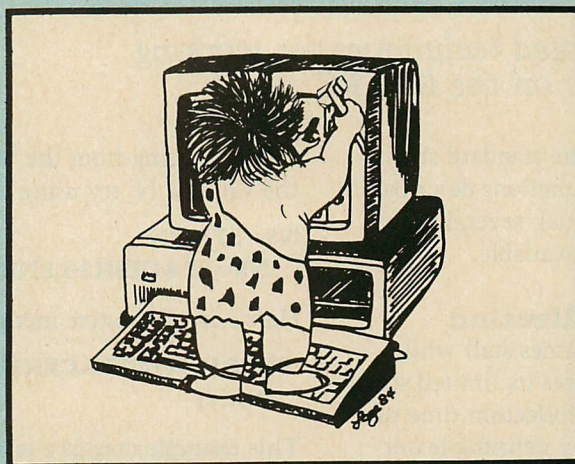


# SCREEN SCULPTOR™

**GENERATES CUSTOMIZED  
INPUT SCREEN PROGRAMS  
IN BASIC AND PASCAL . . .**



THE  
SOFTWARE  
BOTTLING  
COMPANY  
OF NEW YORK



## **BASIC or PASCAL. Easily!**

Generate programs in **BASIC** or **PASCAL**. Your choice. Works with \* **Turbo PASCAL**, \* **IBM PASCAL** or **IBM BASIC** (Interpreter and Compiler). **Easy** to use. Begin productive use in minutes!

## **POWERFUL SCREENS**

Everyone can have professional quality screens to dress up any program. Generate complex, colorful, effective screens in minutes.

## **FULL FUNCTION SCREEN CREATION**

Simply "draw" input screens with word processor style editor.

Advance screen creating features include:

- **Draw boxes, lines, etc.** in seconds with unique character selection menu.
- **Repeat last character** in any direction.
- Special **color-select screen** displays all available colors.
- **Paint and Repaint** sections of screen at any time.
- **Copy and Move** sections of screen.
- **Insert or Delete characters and lines.**
- **Input field definition screen** gives you **total control** of character type definitions, edit screen masks, input sequence, variable names, initial values, protected characters, etc.

## **COMPLETE DATA ENTRY ROUTINES**

Generates customized program code that allows professional quality data input using the full PC keyboard (cursor keys, delete, insert, and more). Checks input data for valid entries and displays error messages.

Programs are easily merged with your own programs.

**Easy to follow documentation** shows how and where you can modify the generated programs.

- Available now with IBM PC, PCjr, PCXT, and all true compatibles.
- Requires 128k RAM, one floppy disk drive, and PC DOS. Works with any 80 column display type.

\* Turbo PASCAL is a registered trademark of Boreland International, Ltd. IBM is a registered trademark of IBM corporation.

**TO ORDER SEE YOUR LOCAL DEALER  
OR CALL (718) 728-2200**

Only **\$125<sup>00</sup>**

(Includes shipping and handling)  
(N.Y.S. Res. Add 8 1/4% sales tax)

Credit Card Orders call 1-800-824-7888. Operator 268

Alaska and Hawaii call 1-800-824-7919. Operator 268

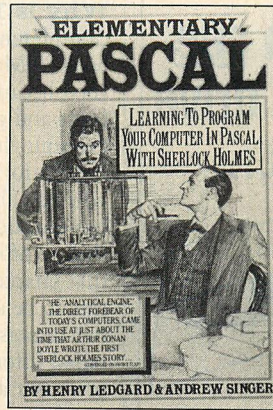
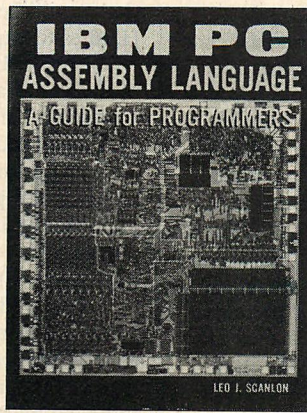
DEALER INQUIRIES INVITED. SORRY, NO C.O.D.

Produced and Distributed by **The Software Bottling Co. of New York.**

29-14 23 Ave., New York City, N.Y. 11105

ITEM No. 3300





## **IBM PC Assembly Language: A Guide for Programmers**

Leo J. Scanlon

(Robert J. Brady Co.; Bowie, MD; 1983)  
311 pages, paper, \$19.95

Although not every programmer wants or needs to program in assembly language, it is the only means of getting the computer under control for many small system owners. Assembly language provides faster programs, access to the powerful built-in BIOS routines, and access to ports—such as the game-adaptor, parallel, and serial ports—from Pascal and APL.

Leo Scanlon's book has been on the market for more than a year. When it was published, it was the only real IBM assembly language book available, now there are half a dozen. A year ago I chose Scanlon's book as the main text for the Microprocessor and Assembly Language course at Broome Community College because it was the only book available. Next year, we will again be using Scanlon's book—this time because it is the best book available.

### **Complete and Detailed**

Chapter 1 of Scanlon's text deals with the "whys" and "hows" of the 8088, and chapter 2 is a step-by-step guide to the use of the IBM Macro Assembler. In chapter 2, Scanlon shows the user how to edit, assemble, and run an assembly language program. He also includes a detailed example of the use of DEBUG for running programs and for examining register contents.

In chapter 3, details of the 8088 instruction set are covered. Instead of just dumping all of the 8088 commands in the user's lap, as some texts do, Scanlon presents a few commands or groups of related commands and gives an example of how they can be integrated into a program. Scanlon says, "This approach is intended to help you understand the

instruction set, and how individual instructions "fit together," so you don't learn them as a bunch of disjointed entities." In contrast, David Bradley's book, *Assembly Language Programming for the IBM PC*, published by Prentice-Hall, handles the topic of the instruction set so poorly that it would be better to say that it isn't covered at all.

Topics in chapter 3 include: addressing modes (direct, indirect, relative, and indexed), instruction types, data transfer instructions (as a group), input/output instructions, flag instructions, arithmetic instructions, bit manipulation instructions, logical instructions, shift and rotate instructions, control transfer instructions, conditional transfer instructions (jumps, etc.), string instructions, move instructions for strings, and interrupt instructions. All of these groups have "little" example programs that teach the proper syntax and use for the instruction.

Chapter 4 is an introduction to high-precision mathematics. Because the 8088 and 8086 instruction set provides for multiplication and division, programmers are spared the necessity of writing programs to accomplish these tasks. In this chapter, Scanlon gives some detailed examples of 32-bit precision multiplication, division, and square roots. These examples teach both proper programming style and a more or less standard technique for achieving multiple-precision answers.

In chapter 5—"Data Structures"—Scanlon again teaches new concepts by using good examples. In assembly language, the concept of data structures usually refers to methods of handling things such as lists, tables, and files. Scanlon discusses how to enter and extract data from unordered and ordered lists, how to find maximum and minimum values in a list, and how to sort (bubble sort) a list. The subject of look-up tables (so often used to hold infor-

mation on graphics characters) is presented as a fast approach to obtaining information on sines and cosines of angles as well as base (radix) conversions. Anyone interested in graphics work on the IBM PC should find this section of great interest.

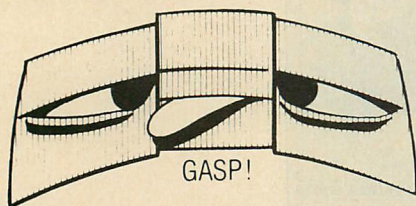
Chapter 6 starts with a discussion of the memory map for the system and quickly gets to the meat of the IBM interrupts and BIOS routines. Scanlon identifies various system interrupts, discusses their potential uses, and gives a table of parameter values that have to be set when calling the interrupt. When dealing with the BIOS interrupts, he shows all of the necessary parameters that are so poorly detailed in the IBM *Technical Reference* manual. This section presents methods of using the BIOS routines to set the video mode, set cursor lines, set cursor position, read the cursor position, scroll a page, write a character to the screen, set color palette, put a dot on the screen (the beginning of graphics!), and more.

The subject of graphics is presented from the assembly language standpoint in chapter 7. It is somewhat disappointing that Scanlon limits his presentation to graphics that can be achieved on the monochrome screen (that is, IBM character set symbols that can be shown on the text screen). However, within the limits that are established, the presentation is handled well. Scanlon touches on the most important fundamental concepts of figure creation (using shape tables) and simple animation. This is an interesting introduction to a fast way to do graphics.

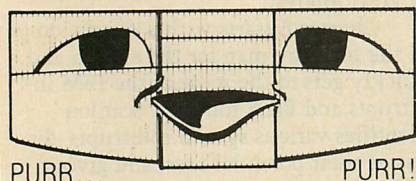
The final chapter is devoted to making sounds from the PC's built-in speaker. Scanlon gives an example called the "Speaker—Beeper Procedure" that will produce a tone of a specified frequency and duration. He then explains how to write a program that plays the song "Turkey In the Straw."



It's too late  
when you can see  
that your disc drive  
has problems...



**ReadiScope**<sup>TM</sup>  
is your eyes and ears  
inside your disc drives.



**ReadiScope** is a comprehensive diagnostic program that analyzes the current status of a diskette drive. It graphically displays the alignment pattern so that adjustments to head, spindle hub alignment, and rotational speed can be made in minutes without special equipment.

- Floppy drives, single or double sided drives, can be tested while installed under normal operating conditions
- Ideal for use by: PC Clubs; Users with Critical Data; Repair Shops; Multi-PC Users; Retail Stores

Requires 48K IBM PC with one operating drive. Uses monochrome or graphics display. \$295, including special diagnostic diskette.

Visa, Mastercard or MO. Add \$3. for shipping. In CT, add 7.5% tax.

Call 203-431-3521 or send your order now to:

**ReadiWare Systems, Inc.**

Box 680, W. Redding, CT 06896

## BOOK REVIEWS

### Why Is This Book So Good?

Completeness alone doesn't make a good book. *IBM PC Assembly Language* is good because it teaches important concepts and good programming style by example, its examples are simple and straightforward enough that a novice will be able to understand them, and it has questions at the end of each chapter that reinforce the concepts presented in that chapter. In addition, I have found this to be a good textbook for the beginner because of the first two chapters' detailed information on the 8088 microprocessor and how to use the IBM Macro Assembler.

There will always be some hardcore programmers who won't leave the first language they learned, whether it be BASIC, Pascal, FORTRAN, or something else. They say, "Why learn another language when I can do anything I want in BASIC or Pascal or FORTRAN?" My answer is this: If you program long enough and hard enough you will need the control of the computer that assembly language gives. When you do, *IBM PC Assembly Language* will be helpful. Scanlon's book is a great introduction to a topic that has received much bad press.

— WILLIAM H. MURRAY

### **Elementary Pascal: Learning to Program Your Computer in Pascal with Sherlock Holmes**

Henry Ledgard and Andrew Singer  
(Vintage Books, New York, 1982)

266 pages; paper, \$12.95; hardcover, \$19.50

This approach is certainly original, and the author (or one of them, at least) is no lightweight. Henry Ledgard is the author of the superb *Programming Proverbs* series. Does this unusual approach work? It all depends on what you assume the book ought to do.

The book is an exceedingly clever novel disguising a beginner's Pascal textbook. In the novel, Sherlock Holmes has obtained access to Charles Babbage's legendary Analytical Engine—which, the authors tell us, is mechanically microprogrammed (so we assume) to execute Pascal programs. Holmes greatly admires the machine's ability to work out logical problems and has begun using the Engine to solve cases that he used to solve by brain power alone. As he solves several mysteries with the Engine, he explains the art of programming to a skeptical Dr. Watson; the authors also provide concluding commentary after each Holmes lecture to clarify items

that would be out of character for Holmes to explain.

I recognize Ledgard's organization of the material. He presents the *idea* of a program before ever displaying a single line of code. He establishes immediately his prime directive that understanding the problem comes *first*, by explaining the initial mystery and laying out the clues before starting in on the notion of writing a program to solve it.

The gradual explanation of the concepts and features of Pascal is done in exactly the right order. Program structure is explained first, followed by data, followed by statements and flow of control, followed by subprograms. The wrap-up is a lucid explanation of programming methods that is lifted essentially unchanged from Ledgard's *Programming Proverbs*.

The example programs each solve a Holmes mini-mystery. Although every bit as clever as the studied Victorian dialogue between Holmes and Watson, these programs are also every bit as contrived, and none of them provides insights into programming problems that occur in the real world, such as sorting files or battling nonstandard hardware.

So I return to the question of whether or not the book succeeds: Will it teach you Pascal? No. It operates at far too high a level of abstraction. To make the book universally applicable, Ledgard has chosen to ignore all real-world computers and implementations of Pascal and all the complications that come of using Pascal in the real world.

But will it teach you *about* Pascal? Yes, indeed. It explains clearly the methodology of top-down programming by using Pascal as an example language. Only the methodology is provided, however, not a full picture of the language.

In a way that's just as well, I can see Dr. Watson turning purple trying to understand Holmes's explanation of error trapping or DOS calls. The book is done with skill and a dry wit—anyone who enjoys Holmes will get a kick out of how well the authors have reproduced the mood of the original stories. As an entertainment that provides a review of structured programming it succeeds beautifully.

I recommend *Elementary Pascal* as a companion text to a more specific text, such as Cortesi and Cherry's *Personal Pascal*, which focuses on two real-life compilers on the IBM PC. Henry Ledgard's magic does not deal with Pascal so much as with top-down programming by successive refinement. A good book knows its limits. This one does.

— JEFF DUNTEMANN



# Mom & Pop Hi-Tech, Inc.

*Incorporating for all the wrong reasons*

There are two ways to become president of a corporation. The first involves years of hard work, astute politics, and luck. This article is about the second.

With the exception of certain special classes of corporations, such as national banks, corporations are creatures of state law. The mechanics of forming a corporation are specified by statute and vary from state to state. The general pattern, however, is simple: a charter must be drafted and submitted to the appropriate state agency along with the appropriate filing fee. The charter is a purely utilitarian document, the literary style of which seldom rises above the level of "FIRST. The name of the Corporation is Mom & Pop Hi-Tech, Inc." The state filing fee is usually nominal.

Once the charter has been approved and filed, bylaws should be adopted, and stock should be issued. It is desirable to issue stock qualified as "1244 stock," which, under Section 1244 of the Internal Revenue Code, creates an ordinary rather than capital loss for its owner if it becomes worthless.

Returning to more optimistic thoughts, directors and officers should be elected, and then everyone should get back to work. In some states, certain formalities (such as the adoption of a corporate seal) must be attended to, and most banks

will ask that corporate resolutions be adopted to open a bank account, (they usually have a preprinted standard form that can be used).

There are limits to how far this technique can go. For example, this method cannot be used to become President of the United States, because the state official charged with filing articles of incorporation would not accept the corporate name "The United States." Likewise, unless there has been a grievous lapse in communications in some remote corner of the country, the official would not accept "International Business Machines" as a corporate name. (Even if a corporation could be formed under that name, the name could not be used as a trademark in the computer field. Trademark rights are independent of corporate name-adoption rights although it is always a good idea to foreclose a competitor's use of a corporate name as well as a trademark.)

Once the first corporation has been successfully formed, it is mechanically simple to form the second. Assuming that no circumstances (including the law) have changed, all that is required is to change the section of the charter that specifies the corporate name and to pay another filing fee. With a PC, a printer, a primitive word processor, and a checkbook, corporations can be multiplied at will. Mergers, dissolutions, and hostile takeovers require fancier software;

pinstripes are optional, but they help.

Those who are looking for a quick way to dress up their resumes and who plan never actually to operate the corporation do not need to read any further—except to note that a corporation is a separate legal entity, different from its incorporator, its stockholders, its officers, its directors, and its employees. That means that an Employer Identification number (the corporate equivalent of a Social Security number) is required, as are certain forms that keep the state advised of the corporation's continuing existence (these forms must be accompanied by the appropriate fee). In other words, there is a price to be paid. Because there is a price for incorporating (in terms of both initial fees and maintenance), the incorporator should have a reason to do so.

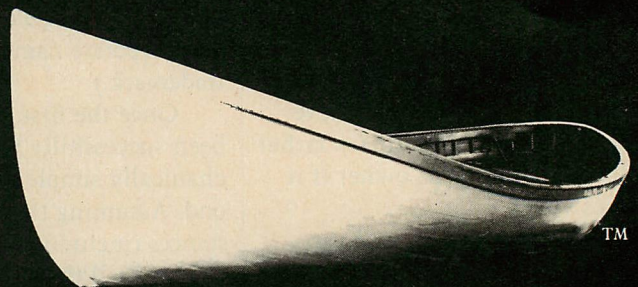
The reason most often given for incorporating is that a corporation provides a means to limit personal liability. If the corporation is not a sham (that is, if it has adequate capital and corporate formalities are observed), it is a separate legal entity, and, therefore, its obligations are not imposed on its stockholders, its officers, or its directors.

The corporate form does place limits on certain types of liability that a co-venturer could impose in a general partnership. General partners are deemed to be agents for one another within the scope of the partnership's business. Therefore, any general partner with "apparent

*Max Stul Oppenheimer is a partner in the law firm of Venable, Baetjer, and Howard, located in Baltimore.*



*C Is The Language.  
Lifeboat Is The Source.*



*Lifeboat.<sup>TM</sup>  
The Leading Source And Authority For Serious Software.  
1-800-847-7078.*

*In NY State: 212-860-0300*



# Serious Software For The C Programmer From Lifeboat.™

**Lattice® C Compiler:** *The serious software developer's first choice.*

Selected for use by IBM,® Texas Instruments, Wang,® MicroPro,® Ashton-Tate,™ IUS/Sorcim,® Microsoft® and Lotus™ to name a few of the many. Why?

Lattice C is clearly the finest 16 bit C compiler available today.

- Renowned for speed and code quality.
- Fully compatible with the C standards set forth by Kernighan and Ritchie.
- Four memory model options offer you unsurpassed control and versatility.
- Superior quality documentation.
- Now includes automatic sensing and use of the 8087 chip.
- Widest selection of supporting add-on packages.

**Halo™:** *A graphics development package rapidly emerging as the industry standard.*

- 140 graphics commands including plot, line, arc, box circle and ellipse primitives, bar and pie charts; pattern fill and dithering commands.
- New: multiple viewports and “stroke text” for angling, scaling and filling text.

**C Food Smorgasbord™:** *This beautifully written collection of C functions is a valuable time saver.*

- Library includes a binary coded decimal arithmetic package, level 0 I/O functions, a terminal independence package, IBM PC ROM BIOS access functions and much more.

**Pmate™:** *The premier editor for the programming professional.*

Pmate is a full screen editor with its own powerful macro command language:

- Perform on screen row and column arithmetic, alphabetize lists, translate code from one language to another, call up other macros.
- Customize Pmate almost any way you like.
- Contains 10 auxiliary buffers for storage of macros, text, subroutines.
- An “undo” feature allows the programmer to retrieve whole series of deleted items.

## Additional C Tools

### Available From Lifeboat:

Panel™: Screen formatter and data entry aid.

Lattice Windows™: Windowing utility; create “Virtual Screens.”

Plink-86™: The popular linker; includes extensive overlay capabilities.

Pfix86™: Dynamic debugging utility.

Pfix86 Plus™: Symbolic debugger with capacity to debug overlays.

Btrieve™: Database record access/retrieval library.

Phact: Multikeyed ISAM C-Function library.

Fabs: Fast access B-tree database function library.

Autosort: Fast sort/merge utility.

ES/P: ‘C’ program entry with automatic syntax checking and formatting.

Greenleaf Functions™: Library of over 200 popular C functions.

And much more.

**YES! Please rush me the latest FREE Lifeboat™ catalog of C products.**

Company  
Name

Business  
Phone

Name

Title

Address

City

State

Zip

Please check the category where Lifeboat can best help you:

- |   |                                     |                                    |
|---|-------------------------------------|------------------------------------|
| <input type="checkbox"/> Software development | <input type="checkbox"/> Corporate  | <input type="checkbox"/> Education |
| <input type="checkbox"/> Dealer/distributor   | <input type="checkbox"/> Government | <input type="checkbox"/> Other     |

Call Direct: 1-800-847-7078 (In NY State: 212-860-0300)

Return coupon to: Lifeboat Associates™  
1651 Third Avenue, New York, NY 10128.





authority" (that is, who seems to be acting as one in this position normally would) can bind the entire partnership and all co-partners. An officer of a corporation can commit only corporate assets, not those of its stockholders. It is possible to establish limited liability in the partnership format by forming a so-called *limited partnership*. The limited

partners are liable only to the extent of their investment in the partnership, but they lose this protection if they participate in the management of the limited partnership.

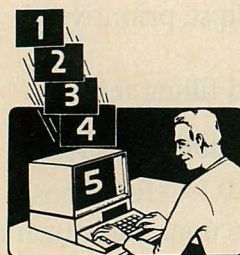
The notion of limited liability is, however, often illusory for a small corporation as well. Although the corporation's debts are not imposed on its stockholders, nothing

prevents the stockholders from voluntarily assuming those debts. For example, a bank lending money to a fledgling corporation will usually ask that the stockholders voluntarily agree to guarantee their corporation's repayment of the loan—or the bank will not make the loan.

If the corporation's sole stockholder is also its only employee, the actions of the corporation may be difficult to separate from the stockholder—if the newly elected president of Mom & Pop Hi-Tech, Inc. drives the company van into a parked police car, can there be any doubt that both the stockholder and the corporation have a problem? Standard practice for corporations is to indemnify their officers and directors against liabilities arising from the performance of corporate duties, but an indemnity is merely a promise to reimburse; it is worth no more than the corporation has, and it does not relieve the officer or director of his liability to third parties. Remaining a sole proprietorship or partnership and buying adequate insurance is frequently less costly than incorporating.

A second reason given for incorporating is the ease of transferring shares of the company. This is true in many cases (assuming that the transfer is exempt from state and federal securities laws; registering with the SEC is not easy regardless of the form of the entity). If the goal is to give every stockholder equal rights in proportion to his holdings, the process simply involves authorizing, then issuing, the required number of shares.

The goal is often more complicated, however. A passive investor of capital may want greater security than the whiz-kid who will actually make the venture work; the whiz-kid may want a larger share of the upside potential. An owner may want to give his hard-working employees a stake in the business, but not let them have a role in its management. These goals can be



## MULTI-TASKING for an IBM PC or XT MULTI-JOB

*"MULTI-JOB the most cost effective choice for the user with a need for multi-tasking"*

Personal Computer Age Volume 3.8  
August/Sept. Issue.

With MULTI-JOB software up to 9 IBM PC DOS compatible programs can be running at the same time. The keyboard and screen can be assigned to any job with a simple keystroke. The remaining jobs will continue to run unattended.

- \* No special hardware is required.
- \* Allows priorities to be given between each job.
- \* Programs can be run simultaneously or one at a time.
- \* Have a true multi-user system with the MTM option.
- \* More cost effective than buying a second machine.
- \* Free 30-day free trial period.

**MULTI-JOB** \$159.00

Gives you multi tasking using PC DOS.

**MULTI-JOB/MTM PACKAGE** \$295.00

Gives you multi tasking and multi users using PC DOS

**ELECTRONIC DISK** \$ 49.00

Creates one or more super fast disk drives from memory.

**SPOOL PROGRAM** \$ 24.00

Will redirect printing to memory.

**SET MEMORY UTILITY** \$ 24.00

Allows you to set the effective size of memory without removing the cover or changing any switches.

**B&L COMPUTER CONSULTANTS, 7337 Northview,  
Suite B, Boise, ID 83704, (208) 377-8088.**



Dealer's inquiries are welcome. Call or write for a free catalog.



achieved (by creating more than one class of stock), but this is not a job for amateurs, and it is not necessarily easier to achieve using a corporate vehicle than it would be through a partnership agreement.

Another reason for incorporating is to centralize and simplify management of the company. For a sole owner, this makes no difference. If the company has several owners, the corporate form makes management easier for those stockholders who are also managers, but (without special provisions in the corporate charter or bylaws) it deprives nonmanagers of control and of access to information concerning the corporation's operations.

One more reason frequently posited for incorporating is the belief that incorporation will provide tax advantages. What incorporation actually provides is tax *differences*. (The IRS publishes a "Tax Guide for Small Business" [Publication 334], which is a good introduction to the subject—provided the reader keeps in mind that it was written by a tax collector. The publication is updated annually, and local IRS offices have copies available gratis.)

A sole proprietor simply runs his business, figures out how much he made or lost in the process, and, at tax time, fills out Schedule C. A partnership is more complicated, but is still essentially a conduit to the individual partners' tax returns.

A corporation (I repeat for the third and final time) is a separate entity. To get it running, assets must be transferred to it (which often can be accomplished tax-free). If the corporation produces a profit, it is taxed on that profit—unless its stockholders have elected so-called "S Corporation" treatment. The corporation must distribute its profits to stockholders who want their share, and the stockholders will be taxed on any dividends they receive. If the corporation produces a loss, it can use that loss to offset past or future profits, but unless S

Corporation status has been elected, the company's stockholders cannot take advantage of the loss on their personal tax returns.

Another tax difference occurs in selling a company. Selling is simpler for a sole proprietor, but it is generally more costly as well. Assuming that the corporation is not deemed "collapsible," (a tax concept that is primarily meant to prevent incorporation for the sole purpose of converting inventory into capital assets, but that has a broader reach), the sale of stock will be a capital gain and may qualify for a reduced tax. When sole proprietorship assets are sold, they are taxed at the lower capital gains rate only if they are capital assets—inventory items treated as if they were sold in the ordinary course of business and taxed at ordinary income rates.

Whether or not these tax differences are tax advantages depends on individual circumstances. The decision to incorporate, and, after incorporation, to elect (and later terminate) S Corporation treatment, must be predicated not just on taxes, or centralizing management, or transferring shares, or limiting personal liability, but rather on the future of the enterprise—anticipated profits and losses and capital need. Try to find a lawyer or accountant with a spreadsheet program. Or, try to find one who has never heard of spreadsheets and offer to teach him or her how to use one in return for helping you decide whether to incorporate—you could become each other's best clients.



## NEW FEATURES

(Free update for our early customers!)

- Edit & Load multiple memory resident files.
- Complete 8087 assembler mnemonics.
- High level 8087 support. Full range transcendental (tan, sin, cos, arctan, logs and exponentials) Data type conversion and I/O formatting.
- High level interrupt support. Execute Forth words from within machine code primitives.
- 80186 Assembler extensions for Tandy 2000, etc.
- Video/Graphics interface for Data General Desktop Model 10



## HS / FORTH

- Fully Optimized & Tested for:  
IBM-PC IBM-XT IBM-JR  
COMPAQ EAGLE-PC-2  
TANDY 2000 CORONA  
LEADING EDGE  
(Identical version runs on almost all MSDOS compatibles!)
- Graphics & Text  
(including windowed scrolling)
- Music - foreground and background  
includes multi-tasking example
- Includes Forth-79 and Forth-83
- File and/or Screen interfaces
- Segment Management Support
- Full megabyte - programs or data
- Complete Assembler  
(interactive, easy to use & learn)
- Compare  
BYTE Sieve Benchmark jan 83  
HS/FORTH 47 sec BASIC 2000 sec  
w/AUTO-OPT 9 sec Assembler 5 sec  
other Forths (mostly 64k) 70-140 sec  
**FASTEST FORTH SYSTEM AVAILABLE.**

**TWICE AS FAST AS OTHER  
FULL MEGABYTE FORTHS!**

(TEN TIMES FASTER WHEN USING AUTO-OPT!)

HS/FORTH, complete system only: \$250.

 Visa  Mastercard

Add \$10. shipping and handling

## HARVARD SOFTWORKS

PO BOX 339  
HARVARD, MA 01451  
(617) 456-3021



# TECH RELEASES

Hardware, software,  
and other developments  
for the PC



PCjr Keyboard

## HARDWARE

**IBM** has introduced new features designed to extend the power and versatility of the PCjr. These features include a new **keyboard**, an optional **IBM PCjr 128KB Memory Expansion Attachment**, an **IBM PCjr Power Expansion Attachment**, and the **IBM PCjr Speech Attachment**.

The new keyboard, now standard with all PCjrs, has 62 individually contoured, full-travel keys with a familiar and comfortable typewriter-like layout, appearance, and touch. It can communicate with the system unit via an infrared signal; an optional connecting cord is also available. The new keyboard will be available at no charge to current PCjr owners and to those who purchase a PCjr from existing supplies.

The IBM PCjr 128KB Memory Expansion Attachment adds 131,072 characters of user memory to a PCjr. Up to three of these attachments can be connected to the computer's side expansion port to boost a PCjr's total memory to 512K. A program included with the memory attachment

permits all or part of the expanded memory to be transformed into a so-called electronic diskette and used as if it were a second disk drive. Price: \$325.

The IBM PCjr Power Expansion Attachment provides the extra power needed to connect more than one memory, speech, or printer attachment to a PCjr. The power attachment supports up to three side attachments in any combination. This attachment is required to use the IBM PCjr Cluster Attachment on PCjrs with an internal modem, diskette drive, or any side attachment. \$150.

The IBM PCjr Speech Attachment is a speech synthesizer that contains 196 built-in words and sounds and that can record speech on a diskette through a microphone input. \$300.

**IBM**

Entry Systems Division

P.O. Box 1328

Boca Raton, FL 33432

305-241-7614

CIRCLE 455 ON READER SERVICE CARD

**C-Pack** (Computer Packaging Technology, Inc.) has designed a new product to facilitate the operation of a net-

work with as many as 16 dumb-terminal workstations. The **Overdrive** system comes configured either as one to three modules that plug directly into expansion slots or as a plug-in expansion chassis. It is available with memory in increments from 64K to one megabyte per user. A single-user system is \$1,495; 4- to 16-user systems start at \$4,995.

**C-Pack**

P.O. Box 129

Mohegan Lake, NY 10547

914-528-0011

CIRCLE 489 ON READER SERVICE CARD



Overdrive

A product to protect PCs from power fluctuations is being offered by **General Interface Systems, Inc.** Called the **PC Uninterruptible Power Source**, the product provides up to 15 minutes of sine-wave power at a 400- or 650-watt output. It receives source power from the AC line and converts it

to 48V DC, which it stores in quick-recovery gel-cell batteries. The unit will kick on whenever the commercial power source deviates from 110V AC. \$850 for the 400-watt model; \$1,495 for the 650-watt model.

**General Interface Systems**

12919 Alcosta Blvd.

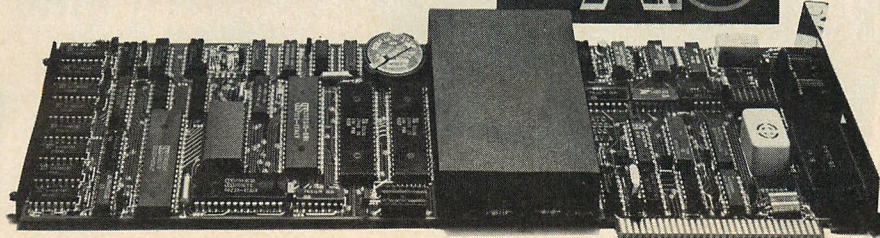
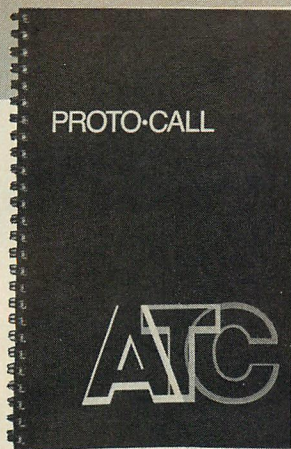
San Ramon, CA 94583

415-838-2683

CIRCLE 487 ON READER SERVICE CARD

One of the first dual-function controller boards for Winchester disks and floppy tape has been introduced by **Sysgen, Inc.** The **SI500** controls two Winchester disks and two floppy disks in addition to one floppy tape drive. It offers full implementation of the ANSI-proposed Small Computer System Interface (SCSI). Sysgen has also developed the **SI520**, a multifunction controller for two Winchester disks and one 1/4-inch streaming tape drive. It supports the SCSI and QIC-02 interface. Both products have a 5 1/4-inch form factor and can support an SCSI data transfer rate of up to 1.25 megabytes per sec-



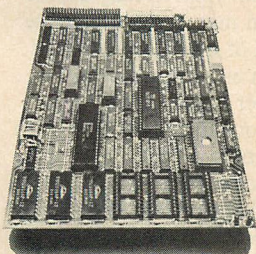


Proto.Call

ond. Prices: SI500, \$400 in OEM quantities; SI520, \$350 in OEM quantities.

Sysgen, Inc.  
47853 Warm Springs Blvd.  
Fremont, CA 94539  
415-490-6770

CIRCLE 488 ON READER SERVICE CARD



Sysgen SI500

**ATC Proto.Call**, a communications package for the IBM PC and PC/XT, has been announced by **American Teleprocessing Corporation**. The product allows the user to run other software at the same time messages are being sent or received; to queue messages to be sent at other times; to send and receive while he is away from the machine; to have access to Telex, TWX, Dow Jones, NewsNet, and other databases and services; and to communicate with either touchtone or pulse dialing. The communications board plugs into a slot and is

equipped with 64K of RAM, 103/212A modem, Z80 microprocessor, real-time clock with battery back-up, and Electronic Industries Association standard port. Proto.Call also comes with communications software. \$995.

**American Teleprocessing Corporation**  
0681 Haddington Drive  
Houston, TX 77043  
713-973-1616

CIRCLE 476 ON READER SERVICE CARD

**Rapport Corporation** has announced an expansion kit for the PCjr that turns the 64K, single-drive machine into a 512K, dual-drive Personal Computer. The **Drive Two Enhancement Package** allows the PCjr to run almost all software available for the IBM PC in addition to jr software. The package includes a 360K floppy disk drive, parallel printer port, clock/calendar with battery back-up, and an expansion slot to increase RAM capacity to 512K. \$675.

Also from Rapport comes the **Companion Keyboard Adapter Cable**, which will connect any IBM PC- or PCjr-compatible keyboard with the jr. The unit

plugs directly into the computer and includes a six-foot coiled cord for the jr keyboard. Rapport also offers the **Companion Audio Amplifier**, a sound system for the PCjr. It includes a 1/4-watt amplifier as well as a 2 1/2-inch, 8-ohm speaker that allows complete audio reproduction when using any monitor at any sound level desired. Prices: Keyboard Adapter Cable, \$39.95; Audio Amplifier, \$24.95.

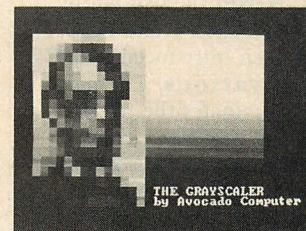
**Rapport Corporation**  
80 S. Redwood Road  
N. Salt Lake City, UT  
84054  
801-292-9454

CIRCLE 485 ON READER SERVICE CARD

**Avocado Computer** has developed a converter that upgrades any color graphics card to gray-scale operation, giving a green, white, or amber screen monitor the legibility, crispness, and power of an RGB display. Called the **Grayscale**, the converter provides 16 levels of brightness and eliminates the "grain" caused by operating from the color card. \$59.95.

**Avocado Computer**  
17352 Yorkshire Avenue  
Yorba Linda, CA 92686  
714-528-1025

CIRCLE 480 ON READER SERVICE CARD



Grayscale

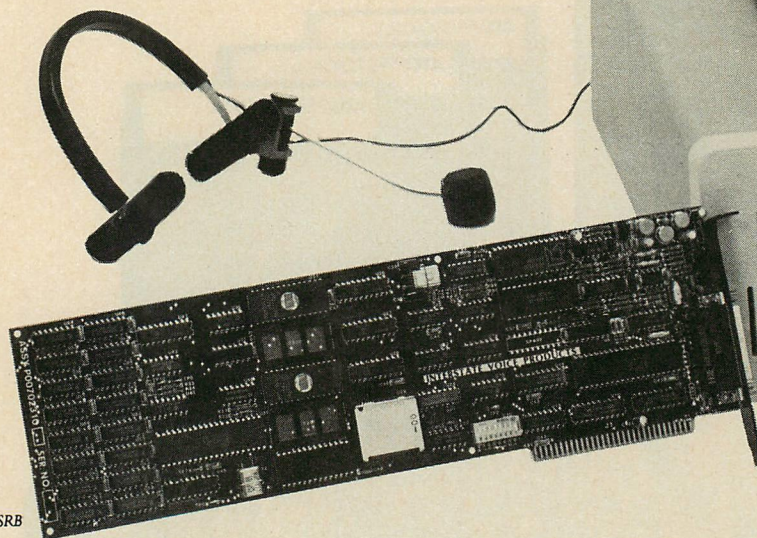
**Taurus Computer Products, Inc.** has announced the **KS100**, an I/O peripheral system that combines an I/O board, termination panel, and software package to use in automated data acquisition and control applications. The product is available in two configurations: the KS101, which handles 16 analog input channels and 16 digital input/output points; and the KS102, which additionally offers 2 analog output channels and 4 event counters. A signal-termination panel provides screw terminal connectors in a configuration identical to the I/O board. Prices: KS101, \$1,454; KS102, \$1,857.

**Taurus Computer Products, Inc.**  
340 Commercial Street  
Manchester, NH 03101  
603-623-7505

CIRCLE 483 ON READER SERVICE CARD



VocaLink SRB



**PC Reset**, a push-button reset for the PC and PC/XT, has been introduced by **PC Innovations**. The product eliminates the need to use the power switch as a reset button and allows the user to bypass the RAM check after the initial power is on. An optional remote-control assembly that can be located near the keyboard is available. PC Reset for the PC is \$44.95; for the PC/XT, \$49.95; and for the remote-control assembly, \$29.95.

PC Innovations  
P.O. Box 4374  
Cherry Hill, NJ 08034  
609-784-1133

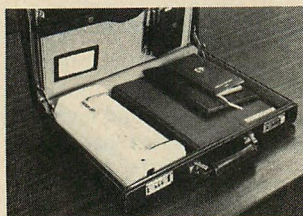
CIRCLE 482 ON READER SERVICE CARD

A low-cost, dot matrix, thermal printer has been introduced by **Ergo Systems Inc.** The **HUSH 80** has 80-column bidirectional printing at 80 characters per second and graphics at 4,800 dots per square inch. Weighing in at 28 ounces, the printer is said to be the lightest portable printer available. It comes with an interface, cable, 100-foot roll of thermal paper, and 9-volt wall transformer with power cable. A nickel-cadmium battery pack is optional. The HUSH 80 is de-

signed to fit into a conventional-size briefcase. \$159.99.

Ergo Systems Inc.  
1360 Willow Road  
Menlo Park, CA 94025  
415-322-ERGO

CIRCLE 478 ON READER SERVICE CARD



HUSH 80

A voice-recognition board that allows users to operate off-the-shelf software with up to 240 spoken commands has been developed by **Interstate Voice Products**. The discrete-word, speaker-dependent **VocaLink SRB** (Speech Recognition Board) occupies a single chassis slot and incorporates a high-speed, 16-bit Intel 80186 microprocessor. It supports two modes of operation: keystroke simulation, which substitutes user-defined verbal commands for keyboard entries to operate standard PC software, and PC

mode for software written specifically to use SRB. Three microphone options are available: a headset with five-foot cord, headset with earphone, and desktop microphone operated with a foot switch. Features include a switch-selectable address to allow one PC to support four SRBs; a software microphone switch to allow the operator to activate or deactivate the SRB through spoken commands; a correction capability to cancel a spoken command by speaking a word defined by the user; and a message asking the user to repeat a word when the system cannot match the voice pattern to the vocabulary. \$1,650.

Interstate Voice Products  
1849 W. Sequoia Avenue  
Orange, CA 92668  
714-937-9010

CIRCLE 486 ON READER SERVICE CARD

The PCjr now can support the Microsoft Mouse and some of the larger, more sophisticated software, such as Lotus 1-2-3, Microsoft Pascal and FORTRAN with the addition of **PCjr Booster with Mouse** from **Microsoft**. The hardware expansion card adds 128K RAM

to jr, almost doubling performance speed on programs that require 128K or less. A battery-backed clock calendar and JBASIC, a software enhancement to the Microsoft BASIC cartridge sold for the jr, are included with PCjr Booster. JBASIC may double screen memory and increase speed of BASIC programs as much as 22 percent. PCjr Booster is \$495 with 128K memory included; \$295 with sockets for 128K.

Microsoft  
10700 Northup Way  
Box 97200  
Bellevue, WA 98009  
206-828-8080

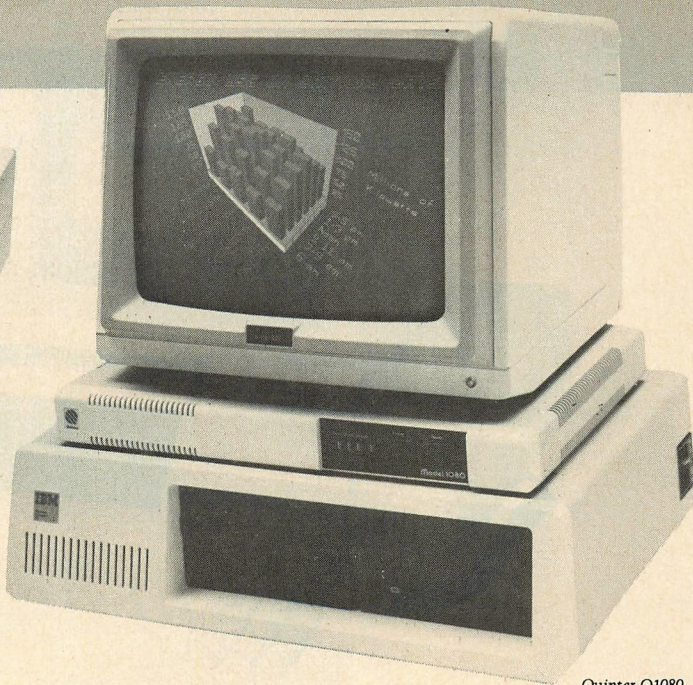
CIRCLE 481 ON READER SERVICE CARD

An expansion multiplexer/amplifier system, the **EXP-16**, is now available from **Metrabyte**. The EXP-16 concentrates 16 differential analog input channels into one analog output channel and also provides signal amplification, filtering, and conditioning. The instrumentation amplifier provides user-selected gains of .5, 1, 2, 10, 50, 100, 200, and 1,000 plus





ProModem 1200

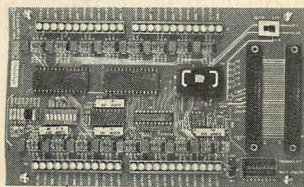


Quintar Q1080

user programming gain capability for special applications requiring specific gain. \$345.

**Metabyte Corporation**  
254 Tosca Drive  
Stoughton, MA 02072  
617-344-1990

CIRCLE 484 ON READER SERVICE CARD



Metabyte EXP-16

**Quintar Corporation** has developed a color graphics controller that enables the IBM PC to interface with a high-resolution color monitor, large-screen video projector, or slide-making device. The controller is offered in two versions: the **Q1000**, with resolution of 512 by 512 by 4, and **Q1080**, with resolution of 832 by 630 by 4. Both provide two full pages of display. Standard features include two 16- by 12-bit color look-up tables, each providing 16 simultaneously displayable colors from a palette of 4,096, four bits of programmable color information for each pixel, and the ability

to combine alphanumeric and graphics on one screen. Q1000, \$1,995; Q1080, \$2,195.

**Quintar Corporation**  
525 Maricopa Street  
Torrance, CA 90503  
213-320-5700

CIRCLE 477 ON READER SERVICE CARD

**Prometheus Products** has introduced a modem that is compatible with Hayes, Bell 103/212A modems. The **ProModem 1200** has a built-in clock/calendar, auto-answer and auto-dial, touch-tone and pulse dialing, built-in speaker with volume control, and optional buffer memory with up to 64K or storage. Also available is 12-character alphanumeric display to provide viewing of the operating status, diagnostic messages, phone numbers, and clock data. \$495; optional buffer card, \$99; optional alphanumeric display, \$99.

**Prometheus Products**  
45277 Fremont Blvd.  
Fremont, CA 94538  
415-490-2370

CIRCLE 475 ON READER SERVICE CARD

## SOFTWARE

**IBM** has introduced the **IBM PCjr ColorPaint** cartridge program. This program requires a user-supplied mouse and provides the user with the ability to draw objects, use different brush styles and patterns, and "paint" with selections from a 16-color palette. \$99.

**IBM**  
Entry Systems Division  
P.O. Box 1328  
Boca Raton, FL 33432  
305-241-7614

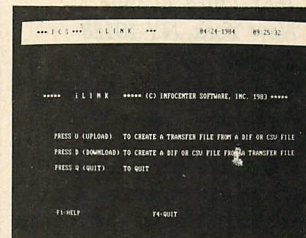
CIRCLE 456 ON READER SERVICE CARD

**InfoCenter Software, Inc.** has announced **iLINK**, a dictionary-driven software transfer program that allows users to download, upload, or crossload data files from IBM PC database and spreadsheet applications to IBM mainframe information center products. iLINK is compatible with all PC applications programs that use DIF or CSV file formats for data management, graphics, and financial analysis (supported programs include Lotus 1-2-3, VisiCalc, SuperCalc, and dBASE II). Features of the package include an electronic note pad, partial

source file extraction, record ID creation, field name and width modification, row/column transposition for each transfer procedure, and automatic default options. Price is \$12,500.

**InfoCenter Software, Inc.**  
171 Main Street  
New Paltz, NY 12561  
914-255-8925

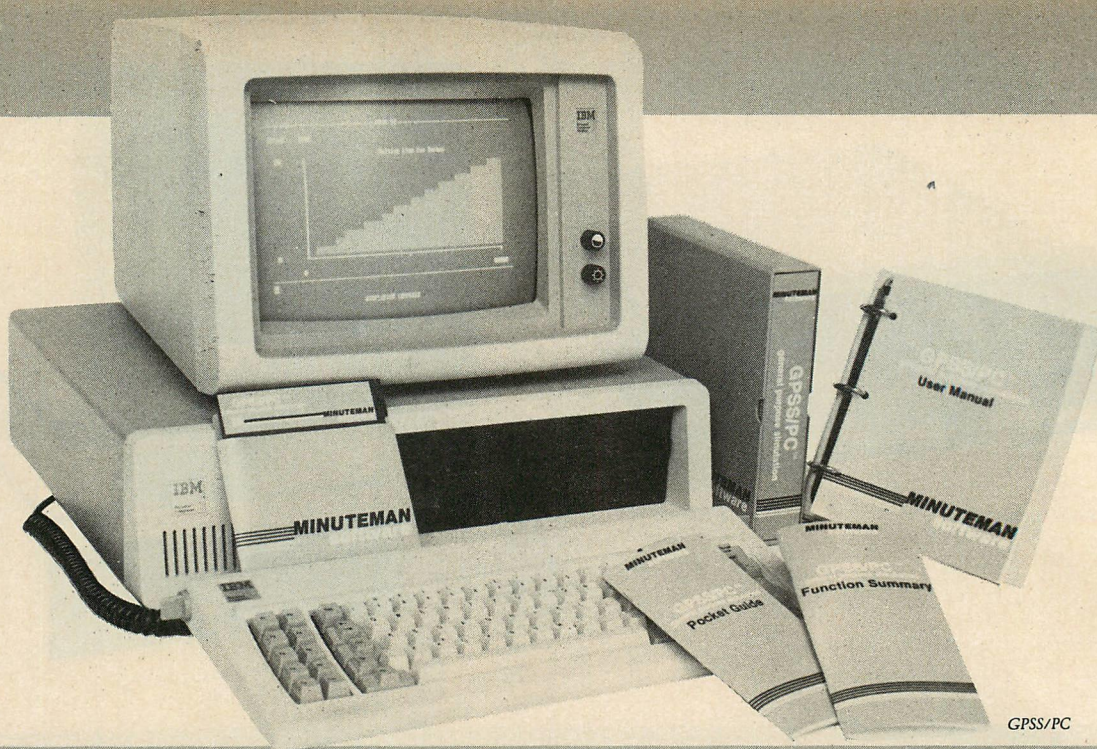
CIRCLE 474 ON READER SERVICE CARD



iLINK Screen

A new computer painting program from **Lifeboat Associates** claims to bring MacPaint-like graphics to the IBM PC. **Dr. Halo** is similar to Apple's MacPaint program in its use of icons and a mouse; Dr. Halo, however, also provides color. Because the program was written with the HALO Graphics Standard, it works with most of the popular graphics





boards sold for the IBM PC and compatibles. Microsoft, Mouse Systems, and Summagraphics mice are compatible with Dr. Halo, as are several digitizers. Images can be printed using the IBM and Epson FX and Grafrax printers and the IDS Prism color printer. \$100.

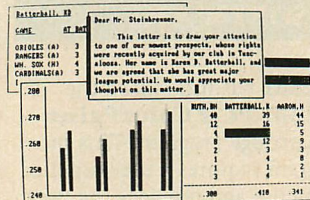
*Lifeboat Associates  
Department C  
1651 Third Avenue  
New York, NY 10128  
212-860-0300*

CIRCLE 472 ON READER SERVICE CARD

**APX Core** from **Application Executive Corporation** allows the user to run concurrently up to eight off-the-shelf IBM PC software programs. For example, text could be written on the screen while both a printer and a modem are in use. APX Core requires 48K of memory, one floppy disk drive, and no extra hardware. Data can be transferred from one program to another, and macros can be defined and saved on disk. \$95.

*Application Executive  
Corporation  
600 Broadway  
Suite 4C  
New York, NY 10012  
212-226-6347*

CIRCLE 473 ON READER SERVICE CARD



Sample Screen for APX Core

**Minuteman Software** has introduced **GPSS/PC Version 1.0**, an efficient implementation of the popular simulation GPSS (General Purpose Simulation System). Using GPSS/PC, it is possible to predict the effects of managerial or engineering decisions on complex real-world systems. The package has more than 70 GPSS blocks and commands. Its features include "infinite" system-clock precision, "infinite" internal precision, full-period 32-bit random-number generators, and mathematic library functions. At least 256K memory is required; large simulations may require as much as 640K. \$900 for one-time license fee.

*Minuteman Software  
P.O. Box 171  
Stow, MA 01775  
617-897-5662*

CIRCLE 461 ON READER SERVICE CARD

**Mylstar Electronics, Inc.** has announced an enhanced symbolic debugger for the IBM PC. Called **MSD**, the product is intended to help programmers decrease the amount of time they spend debugging during the game-design process. MSD uses the same command structure as DEBUG and allows substitution of symbol names and mathematical expressions for hex values. It also contains commands for breakpoint editing, repeat loops, input/output redirection, on-line help, multi-command macros, and other time-saving features. The program requires an IBM PC with one disk drive, a minimum of 128K memory, and DOS 1.1, 2.0, or 2.1. \$125.

*Mylstar Electronics, Inc.  
165 West Lake Street  
Northlake, IL 60164  
312-562-7400*

CIRCLE 471 ON READER SERVICE CARD

**REPORT CARD**, a popular grading system published by **Sensible Software, Inc.**, has been revised for the IBM PC. The program allows teachers of all grade levels to record and monitor the progress of their students easily and quickly. The nu-

merous printing and sorting options can be used to compute and post class rankings. Results can be displayed or printed by individual students or classes. \$59.95.

*Sensible Software, Inc.  
24011 Seneca  
Oak Park, MI 48237  
313-977-3869*

CIRCLE 470 ON READER SERVICE CARD

Version 2.0 of the **SuperSoft FORTRAN compiler** has been released by **SuperSoft, Inc.** It operates under MS-DOS and PC-DOS and contains large code and data space. The user can now have as many 64K code and 64K data segments as desired. In addition, version 2.0 follows the Intel calling format, so SuperSoft FORTRAN code can easily be linked with code from many other micro-computer languages. Debugging has been simplified by using in-line code. \$425.

*SuperSoft, Inc.  
1713 S. Neil Street  
P.O. Box 1628  
Champaign, IL 61820  
217-359-2112*

CIRCLE 467 ON READER SERVICE CARD





Byte Gard

Keyswap

A powerful macro processor called **Keyswap** has been announced by **Rickerdata, Inc.** Keyswap runs in the background, is entirely transparent to the user, and is ready for macro definition at any time. The package has on-line help, an on-line listing of macros, and numerous keyswap command functions. It can be used with most popular applications software, including WordStar, Lotus 1-2-3, and dBASE II. \$115.

*Rickerdata, Inc.*  
P.O. Box 998  
Melrose, MA 02176  
617-662-0856

CIRCLE 460 ON READER SERVICE CARD

Two new products have been introduced by **Cincom Systems: PC CONTACT** and **SeriesOnePlus**. PC CONTACT is an integrated, interactive upload/download communications link between the IBM 370 architecture and the family of IBM PCs. It allows the user to extract corporate data off the mainframe host using MANTIS, Cincom's fourth-generation application-development language. The information can then be downloaded to a PC diskette.

SeriesOnePlus is an inte-

grated decision-support software package for microcomputers. It includes word/text processing, spreadsheet, graphics, data organization, modeling, and report-writing software. \$1,000 for the two packages together.

*Cincom Systems, Inc.*  
2300 Montana Avenue  
Cincinnati, OH 45211  
513-662-2300

CIRCLE 469 ON READER SERVICE CARD

**Intel Corporation** has announced a new version (release 6) of **iRMX 86**, its real-time, multitasking, multiprogramming microcomputer operating system. This release extends the range of microprocessors supported by the operating system to include Intel's iAPX 188, 186, and 286, as well as the iAPX 88 and 86. The operating system can also support single-board computers and systems using these microprocessors. Release 6 of iRMX 86 will be used by OEMs as a system-management facility; it can be tailored to meet the demands of specific applications, which are typically in the machine-directed market—robotics, factory automation, process control, etc.

OEMs can be working at the component, board, or system level. Initial license: \$6,000.

*Intel Corporation*  
5200 N.E. Elam Young  
Parkway  
Hillsboro, OR 97123  
503-640-7147

CIRCLE 468 ON READER SERVICE CARD

The **Hummingbird** operating system has been announced by **Computer Information Enterprises, Inc.** Written in PC native assembly language, Hummingbird is patterned after the IBM Series/1 operating system, EDX. It provides disk, timer, async, and multitasking support. Other facilities include: PC-Series/1 link (including data file and program transfers); support for task synchronization; timed wait; and PC-DOS file compatibility. \$500.

*Computer Information Enterprises, Inc.*  
2685 Dow Avenue, Suite B  
Tustin, CA 92680  
714-838-2171

CIRCLE 466 ON READER SERVICE CARD

**PC/MPX**, a nonpreemptive multiprocessing executive for the IBM PC, has been introduced by **The Austin Code Works**. Built for use

with the DeSmet C compiler, PC/MPX allows a programmer or system designer to run multiple C functions concurrently. Functions share the CPU voluntarily by blocking to relinquish control to other members of the concurrent cooperative. \$45.

*The Austin Code Works*  
11100 Leafwood Lane  
Austin, TX 78750  
512-258-0785

CIRCLE 465 ON READER SERVICE CARD

## OTHER WARES

**Byte Gard** head-cleaning disk is now available from **Precision Computer Products**. It is guaranteed for 260 cleanings or one year of use. The company recommends using its product for up to 30 seconds each working day to remove dirt, dust, and oxide deposits from disk read/write heads. \$39.95.

*Precision Computer Products*  
770 Welch Road  
Suite 327  
Palo Alto, CA 94304  
800-321-2804

CIRCLE 457 ON READER SERVICE CARD



# TECH BOOK

A Special Section for Product and Service Listings

## ACCESSORIES/SUPPLIES

### RESET BUTTON FOR IBM PC

The button IBM forgot. A good reset button is a basic tool for PC (PC/XT) programmers. When your machine is hung up, a touch of the button will quickly reboot your computer. This kit installs easily and mounts out of the way behind your machine. Easy instructions included. Send \$29.80 (add 6% in MN).  
RESET CORPORATION  
P.O. Box 14809  
Minneapolis, Minnesota 55414  
(612) 489-5892

### IBM STYLE BINDERS, SLIPS

Complete program packaging line. D-ring cloth binders, slip cases, floppy pages, game portfolios. Continuous paper with three large holes, 20 lb. to go in binders. Blank disk envelopes. Function key cards tell user your F1-F10 meanings. Call, write for prices. Catalog. Fast service, low prices.  
ANTHROPOMORPHIC SYSTEMS LIMITED  
376 E. St. Charles Road  
Lombard, IL 60148  
(312) 629-5160

## COMPUTER/INSURANCE

### INSURE YOUR COMPUTER

Our small computer policy covers your hardware, software & supplies against almost any physical loss or damage. Limited personal liability too. Business use is permitted. Available in most areas. Competitive rates. For more information & application contact.  
COMPU SURANCE, INC.  
PO Box 561952, Dept PCT  
Miami, FL 33256-1952  
(305) 665-6617

## COMPUTER/SERVICES

### INT'L DOCUMENTATION

INTERNATIONAL DOCUMENTATION provides reliable service in the preparation of foreign documentation & mktg. materials. Service includes translation, typesetting, & graphic art. Clear and accurate documentation in any language is a must. Let INTERNATIONAL DOCUMENTATION make your foreign documentation speak for you.

INTERNATIONAL DOCUMENTATION  
120 Barranca Ave. Suite A  
Santa Barbara, CA 93109  
(805) 965-4761/(213) 990-4886

## HARDWARE/ADD-ON BOARDS

### EPROM & MP PROGRAMMER

PC compatible APROM-2000 card can program 2716, 32, 32A, 64, 128, MCM 68764 EPROMS and also 8748/49/51 processors. The software (CP/M-86, MSDOS) can read, verify and program eproms and uses fast programming algorithm. The zero insertion socket is mounted on an external box. The external box for BI-PO-LAR proms and PAL is also available.  
ADVANCED MICROCOMPUTER SYSTEMS, INC.  
6802 N.W. 20th Ave.  
Ft. Lauderdale, FL 33309  
305-975-9515

### 256K NO SLOT MEMORY

IBM PC-1 owners. Let us install up to 256K RAM on your EXISTING SYSTEM BOARD using NO SLOTS. We improve your IBM PC so it can address the 64K RAM chip, 256K-\$335 (expandable and warranted). DO-IT-YOURSELF KITS—PC-KPC-\$69.95 (\$99.95 assembled). 64K-RAMS-\$5.85 ea.  
ADD-MEM  
22151 Redwood Rd.  
Castro Valley, CA 94546  
(415) 886-5443

### MULTICOMM COMMUNICATIONS

ESE introduces two specially designed RS-232C serial communications adapters for the PC & XT and compatibles. MULTICOMM II has two ports, \$225.00, and MULTICOMM IV, a four port unit, \$445.00. Both have SES's selectable 64K I/O address decoders and use a single interrupt line regardless of the number of ports added.  
ELECTRONIC SYSTEMS ENGINEERING CORP.  
477 Congress Street, Suite 911  
Portland, Maine 04101  
MC/VISA. (207) 773-7778

### FIXED DISK BIOS/BOOT

fiXT boots from DATAMAC, DAVONG, XEBEC, PERCOM, GREAT LAKES, ZOBEX, others. Adds XT-like BIOS interface for your disk to IBM PC or COMPAQ. Plug-in installation. DOS 2.0/3.2/reqd. Specify controller model with order \$70 + \$3 shpg. + tax. MC/VISA (optional volume support at additional cost.)  
GOLDEN BOW SYSTEMS  
P.O. Box 3039  
San Diego, CA 92103  
(619) 298-9349

### DT2801 SERIES ANALOG I/O

Plug-in data acquisition boards with 8DI/16SE analog inputs, high or low level programmable gains, 2 analog outputs, 16 lines of digital I/O, DMA, on-board clock, and on-board microprocessor. Optional software subroutines and screw terminal panels.  
DATA TRANSLATION INC.  
100 Locke Drive  
Marlboro, MA 01752  
(617) 481-3700

## HARDWARE COMMUNICATIONS

### TOTAL PC&XT COMMUNICATION

ESE introduces two extremely powerful communications adapters for the PC&XT & compatibles. One is a unique multi-interrupt RS-232 serial add-on for one OR MORE users; \$139.50, and the second is a programmable 24 line parallel interface; \$119.45 Both have ESE's full 64K selectable I/O address decoders.  
ELECTRONIC SYSTEMS ENGINEERING  
477 Congress Street, Suite 911  
Portland, Maine 04101  
MC/VISA (207) 773-7778

## HARDWARE DISK DRIVES

### 8" & 5¼" FLOPPY DRIVES AND DISKETTES

• 8" flexible disk subsystem—Attractive thin-line design stacks above or below system's unit (19½" × 18" × 3½") ANT with complete documentation. Controller board and software available.  
I-8480 DD, DS, 2.4 MB \$1495  
I-8481 SD, DS, 1.2 MB \$995  
• 5¼" internal disk drives—TANDON or Control Data—DS, 40 ATP1, 320 KB.  
TM 100-2 \$235 • CDC 9409 \$249  
5¼" half height internal disk drives available.  
• Control Data diskettes—1240-00 5¼" SS/DD w/write protect notch in hub ring—bx of 10 \$22.  
1244-00 5¼" DS/DD \$35. 1225-00 8" DS/DD wprn \$39.50. VISA/MC.

## MICROXPRESS

MICROXPRESS  
305 S. State College, Suite 135  
Anaheim, CA 92806  
(714) 632-8512

## MAILING LISTS

### IBM MAILING LISTS

Over 100,000 names of IBM personal computer owners (counts increase daily) available for rental on labels or magnetic tape. Total 600,000 including other brands. Plus IBM + compatible retail store + 50 other lists. Call or write for free catalog.  
IRV BRECHNER  
TARGETED MARKETING, INC.  
Box 5125  
Ridgewood, NJ 07451  
(201) 445-7196

## SECURITY

### DATA PADLOCK

DATA PADLOCK is a software implementation of the National Bureau of Standard Data Encryption Standard. Written in Assembler. DATA PADLOCK offers max speed with no increase in file size. An 8 character password provides the key for encryption. Protect sensitive data, text or program files from unauthorized access. Works with all DOS versions \$150. VISA/MC.  
GLENCO ENGINEERING  
3920 Ridge Ave.  
Arlington Hts., IL 60004  
(312) 392-2492

## RATES AND INFORMATION

Listings are grouped by category and consist of a bold lead line (23 characters maximum), 7 lines of ad copy (45 characters per line), plus 4 lines of company name, address and telephone number.

Listings are available only on a 3 issue basis at \$90. per issue (\$270. total). Copy will have a set format and remain the same for all 3 months. Enhance the appearance of your ad by including your Logo and an additional cost of \$25. per issue (\$75. minimum extra charge). Pre-payment is required by check, money order, or American Express, Diners Club, MasterCard, Visa credit cards. Closing Date: 1st of 2nd month preceding cover date.

Send copy and remittance to PC TECH JOURNAL, TECH BOOK, 12th FLOOR, 1 PARK AVENUE, NEW YORK, NY 10016. Call (212) 503-4506 for additional information or assistance.



# TECH BOOK

## SOFTWARE/BUSINESS

### dINVOICER + PLUS

MENU-DRIVEN BILLING & ACCOUNTS RECEIVABLE MANAGEMENT SYSTEM. Produces Invoices, Aged Statements, Invoice Journals, Receipts Journals, Aged Customer Account Status, Past Due Notices, etc. Available with modifiable source code for dBASE II users \$129 or as a stand-alone Run-time package \$199. DATAMAR SYSTEMS  
819 Gage Dr.  
San Diego, CA 92106  
(619) 223-6444

### EXPERT SYSTEMS

Create your own expert systems with EXSYS. All input is English text or menu selection. Uses full 1000K and probabilistic IF-THEN rules. Expert systems developed marketable without royalty. Demo disk including text of manual \$10 (refundable). Full program—\$200. Requires 128K or more. EXSYS  
P.O. Box 75158  
Contr. Sta. 14  
Albuquerque, MN 87194

### PC ACCOUNTING SYSTEM

Professional Accounting for small business or home use. No codes to forget: all lookups are alphabetic. Shows effect of each entry on the screen in English. Supports 20 business units, 1000 account codes, and 10,000 customers or vendors. Reports by business or consolidated in detail/summarized on screen/printer. Color/mono dual/floppy/hard disk. \$69.95 (VISA/MC/CHECK/COD/MO). NYS add 7% tax. PEGASUS SYSTEMS, INC. Dept. T  
30 Harbour Pointe  
Buffalo, NY 14202  
(716) 852-2969

## SOFTWARE/BUSINESS OPPORTUNITIES

### SOFTWARE AUTHORS

WE WILL CONNECT YOU TO MAJOR SOFTWARE PUBLISHERS FREE. We are in contact with many publishers looking for marketable software. If you have a quality software package or program and wish to have it published and distributed, contact:  
SOFTSEARCH, Inc.  
P.O. Box 281  
Budd Lake, NJ 07828  
(201) 627-1790

## SOFTWARE/COMMUNICATIONS

### TELEX LINK SOFTWARE

Link your computer to telex service via ITT, RCA or Western Union with Cawthon's telex software. Designed specifically for telex communications, Cawthon software is easy to use, has on-line help, self-test diagnostics, frequently called numbers, and an excellent User's Guide. Cawthon software is available for many computers and operating systems.



**Cawthon Scientific Group**

CAWTHON SCIENTIFIC GROUP  
24224 Michigan Avenue  
Dearborn, Michigan 48124  
(313) 565-4000 Telex: 810-221-1265

## SOFTWARE/COMPILER

### DESMET C—\$109

Full K&R C compiler, assembler, linker, librarian, full-screen editor and example software. Both 8087 and floating point libraries. OUTSTANDING PRICE/PERFORMANCE. Rated 1st or 2nd in August '83 BYTE benchmarks. No royalties on generated code. C Ware newsletter. Unlimited updates at \$20 each. PC-DOS (Ver 1.1 & 2.0), generic MS-DOS and CP/M-86 support. \$109 for complete package, shipping included. Now available with source level debugger. Price \$159.

**C W A R E**  
CORPORATION

C WARE CORPORATION—MAIL ORDER DEPT.  
P.O. Box 710097  
San Jose, CA 95171-0097

### WIZARD C COMPILER

The power of C with the thorough diagnostics of PASCAL. Full LINT diagnostic integrated with compiler. Full UNIX SYSTEM 3 compatibility. Floating point library; fast compact code; 1 register variable. In-line assembly code. UNIX emulation library. Uses MICRO-SOFT linker. PC/MS DOS 2.0 only. \$450.00. WIZARD SYSTEMS SOFTWARE  
11 Willow Court  
Arlington, MA 02174  
(617) 641-2379

## C SOFTWARE DEVELOPMENT

- Full C Compiler per K&R  
Inline 8087 or Assembler Floating Point  
Full 1 Mb Addressing for Code or Data
  - MS DOS 1.1/2.0 Library Support  
Program Chaining Using Exec  
Environment Available to Main
  - c-window™ C Source Code Debugger  
COMBINED PACKAGE \$199
- c-systems  
P.O. Box 3253  
Fullerton, CA 92634  
(714) 637-5362

### C-FUNCTION LIBRARY \$29

100 C functions, macros, assembly functions. Screen, cursor, keyboard, string, BIOS and DOS access, of course. Plus BASIC equivalent, utility and many more you don't have but need! Just one can save you five times the cost of entire package. Manual w/source code \$29.95. Manual + 2 disks: source + 5 libraries \$49.95. Latex or Microsoft C. (DeSmet and CI soon). ENTELEKON  
12118 Kimberley  
HOUSTON, TX 77024  
(713) 468-4412

### SPARRY BASIC—B COMPILER

Powerful basic compiler that means business.  
\* Instructions support internal ISAM files.  
\* Four virtual screens, recall time <1 second.  
\* Use all use of all memory for basic programs.  
\* 13 significant digit integer math package.  
\* Demos with tutorial and reference manual. Price \$159. Quantity discounts VISA/MC/CHECK. Mass. res. + 5% tax req. PC DOS with 128K. SPARRY SOFTWARE LABS  
PO Box 632 #A  
Milford, MA 01757  
(617) 473-5435

## SOFTWARE DEVELOPMENT TOOLS.

### THE FORMS DESIGNER™

Attention IBM Pascal, FORTRAN users! Save time in designing formatted screen I/O. Interactive Forms Editor allows you to draw lines and boxes, define fields, and edit text. Access forms or read keyboard entry by writing only one line of code. Provides sequential data retrieval and storage. Requires 128K RAM. Only \$275 complete. Demo and manual \$35. Call or write:  
BIT SOFTWARE  
PO Box 619  
Milpitas, CA 95035  
(408) 262-1054

### FREE FREE FREE

BASIC AIDS FACT SHEETS and our guide titled "MAKE YOUR PC PROFITABLE" are sent free to persons who request them. Learn more about developing Structured Programs in BASIC. This new release of BASIC AIDS is the most powerful program DEVELOPMENT and DOCUMENTATION tool available!  
TULSA COMPUTER CONSORTIUM  
P.O. Box 707, 1004 North Dogwood  
Owasso, OK 74055  
(918) 747-0151

## C-INDEX+

C index plus provides complete data management for C language applications development. Includes variable length data storage, B+ Tree ISAM indexing, interactive tutorial. Supported compilers. Lattice & CI-C86. No application royalty fee. Object code license: \$400. Demonstration package: \$25. TRIO SYSTEMS  
2210 Wilshire Blvd. Suite 289  
Santa Monica, CA 90403  
(213) 394-0796

## SOFTWARE PERFORMANCE PROFILER

THE PROFILER™ will tell you where your program is spending its time and allows you to do performance tuning on your code. Works with any language, data printed in histogram form. Easy to use and interpret. Complete user manual provided. Requires DOS 2.0 or better and 64K. \$175.00 VISA/MC OK. DWB ASSOCIATES  
PO BOX 5777  
BEAVERTON, OREGON 97006  
(503) 629-9645

## PASCAL/FORTRAN/C UTIL

Written in assembly language, Pascal/Fortran/C Utilities control screen, keyboard, graphics, music, lightpen, mouse, joystick, printer, RS—232, & I/O ports. Line/circle/ellipse/pie, clipping, windowing & animation. Terminal emulator, random #, BIOS/DOS calls. W/150 pg. manual, demos. Specify compiler. \$119. Check/VS/MC. SOFTWARE LABS  
1221 Matisse Street  
Sunnyvale, CA 94087  
(408) 730-8108

## RAPID BASIC PROGRAMMING

SAVE VALUABLE TIME WITH THESE EFFECTIVE TOOLS:  
—R—Reference line numbers & variables used;  
—A—Alter or find string in program or file;  
—P—Peripheral input/output interchange prog;  
—I—Include basic subroutine source modules;  
—D—Duplicate variables in 2 modules listed.  
SOURCE MICROSOFT BASIC FORMATS ALL FOR \$49.95.  
JAMES HALSTEAD & ASSOC.  
1551 Plainfield Road  
Joliet, IL 60435  
(815) 725-0346

## COBOL GENERATOR

Generates IBM PC or MS COBOL  
• Screen Design/Data Dictionary  
• Structured Program Generator  
• Query/Report Generator  
From \$250—send for information  
—The COBOL Experts—  
• Manframe to PC conversions  
BOMAC SYSTEMS  
P.O. Box 10670  
Pittsburgh, PA 15235  
(412) 795-3581



# TECH BOOK

## TOOLS FOR PROGRAMMERS

- **FILE TOOL KIT.** COMPARE lists file differences, COMPRESS shrinks files, ENCRYPT secures valuable data, HEXDUMP lists files in hex and ASCII.
- **PASCAL TOOLKIT.** PXREF prints program cross-references; PNEAT prettyprints programs. PCASE highlights variables. Just \$29.95 each, both for \$49.95. VISA/MC accepted.

SEVEN VALLEYS SOFTWARE  
P.O. Box 99  
Glen Rock, PA 17327  
(717) 235-5470

## PADLOCK/PADLOCK II DISKS

PADLOCK furnishes the user with a method for providing protection against unauthorized duplication from DOS commands \$99. PADLOCK II disks come preformatted with finger-print and serialization. PADLOCK II disks offer superior protection. Ask about our fast data encryption product. All work with hard disk, EXE/COM files and all DOS versions. MC/VISA.

GLENCO ENGINEERING  
3920 Ridge Ave.  
Arlington Hts., IL 60004  
(312) 392-2492

## FULL CONTROL FROM BASIC

Cut development time, add speed & power to your programs w/NLIB. A library of assembly language subroutines callable from BASIC: execute COM & EXE files, save & restore areas of the screen, clear & scroll windows, much more! Add DOS functions to your menus. Create fast help screens. Unlimited uses. All DOS Versions \$49.95 + \$2.50 s&h. MC/VISA/CHECK. PA + 6% tax.

NATIONAL SOFTWARES  
65 East Elizabeth Ave.  
Bethlehem, PA 18018  
(215) 867-4800

## BASICWINDOW

Screen Generator and Processor for BASIC programmers. This package combines a Screen Painter for creating and modifying screens and Macro Language and Compiler for quicker coding and testing. Features COLOR, field variables, complete input editing, line drawing. For BASIC, BASICA, and BASIC Compiler users. Includes manual and reference card. \$99.95 VISA/MC accepted.

## BasicWindow™

G. FREEMAN & COMPANY, INC.  
15 Albin Road  
Stamford, CT 06902  
(203) 327-9868

## dSEARCHER QUERY UTILITY

A professional searching tool for dBASE II files. Uses simple query syntax with report, recall, and edit facilities for single file searches of any complexity. Creates reusable command programs to search unlimited number of files for "like" data. Tutorial incl. \$79.00. Visa/MC/COD. Call/write for info.

MICRO BYTE  
P.O. Box 245  
Burke, VA 22015  
(703) 569-6473, (703) 451-8717

## FIX DOS WITH A.K.A.!

Take full advantage of multiple directories—let unmodified programs access files outside of the current directory without pathnames. Alias file name to full paths, or direct searches to other directories according to name or extension, with multiple options. Operation is invisible—aliases are contained in the DOS 2.0 "environment." \$60. MC/VISA.

SOFTSHELL TECHNOLOGYS  
54 Walnut Hill Rd.  
Newton, MA 02159  
(617) 332-8186

## BASIC RAM GRABBER II

With these 20 FAST subroutines, array sizes are limited only by amount of RAM installed on your PC. Chained programs can use up to 512KB for passing common variables. Software provided to reserve up to 512KB for string, integer, single and double precision arrays. Many other powerful features included. For both interpreted and compiled BASIC programs. \$49.95 + \$2 shipping. Accept check, MO, VISA/MC. All orders shipped within 5 days. Express mail add \$10. For more information or to place an order, call or write NOW.

P&C Software  
2152 37th Street  
Los Alamos, NM 87544  
(505) 662-7258

## DOS PATH COMMAND FOR DATA

Now Lotus 1-2-3, dBASE II, WordStar and most others can access data files no matter where they are located! Works with hard disks and floppies. DPATH is a system stay-resident function that allows you to organize your disk any way you like. Includes a screen-oriented maintenance utility & a 60-page manual. DOS 2.0/compat. \$25.

PERSONAL BUSINESS SOLUTIONS INC.  
PO BOX 757  
Frederick, MD 21701  
(301) 865-3376

## FILE DIFFERENCE PROGRAM

Compares two MS-DOS text files on a line by line basis. Produces a report of lines and blocks changed, inserted, and deleted. Extensive look-ahead and backtracking for intelligent operation on any programming language or text file. An invaluable programming tool, only \$45. Send ck/mo.

DCP SOFTWARE  
4125 Blackford Ave., Suite 205  
San Jose, CA 95117

## DISK MECHANIC

THE ULTIMATE Floppy Disk Backup & Repair Utility. Can back up ALL software protected disks written on the IBM PC. Works manually or automatically. Files or sectors can be restored, searched, examined & changed. Checks disk drive speed. Req. IBM PC, DOS 1.1 (128K)/2 (192K) + 64K if only 1 floppy drive. \$73 ppd. USA

MLI MICROSYSTEMS  
PO BOX 825, Dept. TB  
Framingham, MA 01701 USA  
(617) 926-2055 for info MC/VISA

## EASY WINDOWS WITH C

Linked to your main C program, CRIOS provides easy screen management and yet is friendly to your end-user. Driven from a simple screen format string, it allows 8 windows, input and output variables, cursor positioning, scroll, change screen attribute, many other features. For Latice C compiler and DOS 2.0. \$49.95.

LRM SYSTEMS  
4438 Donna Drive  
Cleveland, Ohio 44143  
(216) 383-9831

## SDA FILEPAQ VERSION 1.0

Four DOS 2.n file utilities that can with a single command, on one or many directories; locate files and their file descriptions; generate sorted file lists by name, extension, size, and/or attributes; delete files; remove directories; modify file attributes. Wild cards used in path names.

\$29.50+\$2.50 S/H  
SDA Associates  
PO Box 36152  
San Jose, CA 95158  
(408) 281-7747

## SDA OKIPAQ VERSION 1.0

Three Okidata 92/93 printer utilities that allows automatic printing of all 255 IBM PC characters as well as medium resolution graphics screen images. In addition, the printer attributes can be easily set with a single command from the terminal. Extends the use of the Okidata 92/93.

\$29.50 + \$2.50 Shipping/Handling.  
SDA ASSOCIATES  
P.O. Box 36152  
San Jose, CA 95152  
(408) 281-7747

## FILEPATH VERSION 2.0

Unleash the power of DOS 2.0/2.1 subdirectories. Defines search paths for files like PATH does for commands. Wildcards used in path definitions. Eliminates the need for multiple Default, Help, Configuration, and Overlay files dBASE II, etc. \$24.50 + \$2.00 Ship/Handling.

SDA ASSOCIATES  
P.O. Box 36152  
San Jose, CA 95158  
(408) 281-7747

## SOFTWARE/WORD PROCESSING

### PELADA TEXT ENGINEER

Word processing for scientific and multilingual text. All IBM characters. Super/subscripts, italics, underlining, bolding. With graphics hardware, you can use any symbols and any alphabet, up to 384 characters. All symbols visible on screen and printable. Easy English commands. \$250.

PELADA INFORMATICS INC.  
562 Johnson Street  
Kingston, Canada K7L-2A1  
(613) 549-1747

### VOLKSWRITER DELUXE

Features TextMerge™ for customized mailing lists; multi-lingual, engineering & scientific symbols; horizontal scrolling to 250 characters; document size 1 megabyte; on-screen page endings, underline, boldface, double-strike, strike-through, multiple fonts & colors—fewest key-strokes per function. Only \$295.

LIFETREE SOFTWARE INC.  
411 Pacific Street  
Monterey, CA 93940-2790



# TECH BOOK

## SOFTWARE/ LANGUAGES

### ADA ON A MICRO

JANUS/ADA is an exceptional programming language for software development. Being a subset of the Ada programming language JANUS/ADA implements those features of Ada which are directly needed by professional programmers. These features include separate compilation, user defined data types and helpful program debugging.

R.R. SOFTWARE  
P.O. Box 1512  
Madison WI 53701  
(608) 244-6436

### APPLICATION DEVELOPMENT

Build any application in a fraction of the time it would take with BASIC or COBOL. TPL combines conventional programming language constructs with a database manager, screen handler, and report generator in a powerful, yet flexible application development system. Full TPL system \$250. Manual/Demo \$50.

Randak Systems  
346 N. Kanan Road, #204  
Agoura, CA 91301  
(818) 706-3737

## SOFTWARE/ MAILING PROGRAMS

### PONY EXPRESS XL

Designed for commercial mailings or extra large lists. Super fast machine code multi sort. Carrier route sort. Prints labels: 1-5 across, single line format, or user-defined format. Also CHESHIRE FORMAT. Unlimited files. Multi file merge. Records can be selected by user-defined codes, specific zips or zip ranges. Phone list option. Unique correction & deletion routines for updating. Instant access to all records. Auto repeat for ease of record entry. Interfaces w/most word processors. \$238.

COMPUTECH  
975 Forest Ave.  
Lakewood, NJ 08701  
(201) 364-3005

## SOFTWARE/OPERATING SYSTEMS

### MULTIPLE USERS UNDER PC DOS

MultiLink turns PC-DOS into an efficient multi-user multi-tasking operating system. Additional users are supported by attaching inexpensive CRT terminals or modems to serial ports on the PC, and can run normal applications designed for PC-DOS. Includes host communications software for public dial-in.

THE SOFTWARE LINK INCORPORATED  
6700 23B Roswell Rd.  
Atlanta, GA 30328  
(404) 255-1254

## SOFTWARE/SORT

### OPT-TECH SORT/MERGE

Extremely fast Sort/Merge program for the IBM-PC. Can sort or merge multiple files containing fixed or variable length records. Run as a DOS command or call as a subroutine, plus many other features. Now also sorts dBASE II files! Compare before you buy any other. Write or call for more info. \$99.

OPT-TECH DATA PROCESSING  
P.O. Box 2167  
Humble, TX 77347  
(713) 454-7428

### INTERNAL SORT FOR BASIC

NSORT—A FAST & easy to use quicksort subroutine written in C & assembler, CALLable from BASIC. Sorts an unlimited number of records in memory on up to 8 keys of mixed type, ascending/descending. Like having a SORT built into the language. Works w/compatibles. Compiled and Interpreted, all DOS versions. \$49.95 + \$2.50 s&h. MC/VISA/CHECK. PA + 6% tax.

NATIONAL SOFTWARES  
65 East Elizabeth Avenue  
Bethlehem, PA 18018  
(215) 867-4800

## SOFTWARE/TERMINAL

### BLUELYNX

Replace your dumb terminals with smart PCs and XT's. TECHLAND SYSTEMS is the nation's leading synchronous communications company with over 6,000 BLUELYNX' installed. The BLUE-LYNX hardware/software product emulates the 5251/12 for the S/34, S/36 and S/38. Now bundled with Autolynx for unattended operation ... only \$745. BLUELYNX 3276 for the larger 43xx and 30xx mainframes, both SDLC and BSC versions, now comes bundled with Data Reader, a utility that facilitates the formatting of host files into Lotus 1-2-3, dBase, etc.... only \$795. Printer and up-and-download support available with both versions.



TECHLAND SYSTEMS, INC.  
25 Waterside Plaza  
New York, NY 10010  
(212) 684-7788

## SOFTWARE/ TYPESETTING

### HIGH-TECH TYPESETTING

Transmit your text via toll-free lines directly to our fully automated typesetting system. \$2. per K characters with a \$5. minimum. Same day service. 200 typefaces in sizes up to 72 point. Send \$15. + \$3. shipping for our 220 page guidebook, or call toll free and use your MC, VISA or AMEX.

INTERGRAPHICS INC.  
106A South Columbus Street  
Alexandria, VA 22314  
(800) 368-3342 or (703) 683-9414 in DC area.

## SOFTWARE/UTILITIES

### IBM-PC COBOL PROGRAMMERS

Screen coding is fun, fast and accurate with Qwik-Screen Builder. "Paint" screen layout and create true COBOL source code for screen section in minutes. 100+ pages of documentation. Satisfaction guaranteed or money back. Needs DOS 1.1/2.0, two DS/DD drives, monochrome display and the COBRUN. EXE runtime module. \$50/Visa/MC. THE COMPUTER WORKS  
P.O. Box 1371  
Coeur d'Alene, Idaho 83814  
(208) 667-6152

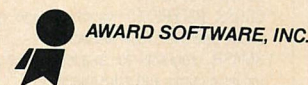
### SNOOP DISKETTE UTILITY

Produce graphic maps of diskettes and files. Comprehensive diskette analysis. Add, delete or modify labels. Pageable directory. Change file attributes. Display, modify or search sectors or files. Much more, all in a single, easy-to-use program. Documentation included. Introductory price \$40. SASE for information.

OTTER CREEK SOFTWARE  
75 Hunting Lane  
Goode, Virginia 24556

### CONVERTS ANY CPM TO DOS

CROSSDATA CONVERTS ANY DATA/TEXT FILE format from CPMxx to MS/PC-DOS, CPMxx to CPMxx & MS/PC-DOS to CPMxx. Cross data runs on IBM PC or comparable computer using MS/DOS 2.0. Cross data is a self-contained program. It comes with over 24 mats and user can add own format. To order send \$99. check or money order to:



AWARD SOFTWARE, INC.  
236 North Santa Cruz Ave.  
Los Gatos, CA 95030  
(408) 395-2773

### COPY PROTECTION BY MSD

The ULTIMATE diskette copy protection system designed by software developers and publishers. A variety of protection methods are available to suit your protection requirements. All IBM PC and XT environments are supported which includes. DOS, BASIC (compiled and interpretive). Pascal, P-System and stand-alone systems. Customized systems also available. Requires: 64K, two disk drives.

MICRO-SOFTWARE DEVELOPERS, INC.  
214 1/2 West Main Street  
St. Charles, Illinois 60174  
(312) 377-5151

### Hard Disk DIRECT ACCESS™

The ULTIMATE utility for any hard disk user. DIRECT ACCESS is a powerful hard disk management tool. Organizes your software programs into a "user defined" menu system. Features attractive screen display, rapid access into an application using a single keystroke & easy to learn. Also handles batch files & complicated DOS commands. Order today. Only \$44.50 + \$2.50 shipping & handling. MC/VISA. DELTA TECHNOLOGIES  
P.O. Box 1104  
Eau Claire, Wisconsin 54702  
(715) 832-0958



# TECH BOOK

## C LIBRARY UTILITIES

Don't reinvent the wheel. Save time & money. Do a better job. Extensive library with source. Best screen handling available. Sound, graphics, DOS 2, printer, comm, date, time, and more. 150+ functions. DOS/BIOS gate gives complete control of your PC. C86, Microsoft, Lattice. Intro. offer \$79. Demo \$30.

ESSENTIAL SOFTWARE, INC.  
PO BOX 1003  
Maplewood, N.J. 07040  
(914) 762-6605

## BASIC DEVELOPMENT TOOLS

Increase your BASIC programming productivity with these preprocessors, filters, and utilities. All programs run from DOS level. All except NUMBER and LABEL work with binary format files! No need to save in ASCII.

- \* NUMBER programs written with your text editor using labels.
- \* LABEL programs written using line numbers. Identify entry points.
- \* CROSS REFERENCE variables, line references, and Basic reserved words.
- \* SMASH programs to smallest space. Removes remarks and extra spaces.
- \* COMPARE two Basic programs, documenting differences line-by-line.
- \* MERGE with delete. Combines two program fragments in line number order.
- \* LIST up to 20 programs with page headings and numbers without operator intervention.

Send \$100 for complete kit, including manual and application notes, or write for info.

Datasmith, Inc.

Box 8036

Shawnee Mission, KS 66208

Phone: (913) 381-9118

## CBTREE for C Programers

Provides enhanced file access function calls directly into C programs. Maintains balanced B-trees, supports unlimited number of data records, keys, data files & key lengths. Dynamic memory allocation. Fast, Flexible, efficient. Object modules avail. or major C compilers. No royalties; Source code separate. \$179.

MICROCOMPUTING SERVICES

2009 Hileman Road  
Falls Church, VA 22043  
(703) 893-0118

## 800 ANSWERING SERVICE

Are you missing out on orders because your clients won't call collect or use their own nickel? Our 800 ANSWERING SERVICE will take your orders, inquiries and so forth. Economical, efficient. WORLD 800, 3435 St. Mary's Rd., Lafayette, CA 94549. (800) 235-6646 or (800) 235-6647 in CA.

## TEXT FORMATTER ...

An assembly subroutine that when used in your BASIC and other programs formats text automatically on screen. NEVER splits line in middle of word! Justifies on screen! Centers. Clear and scroll sections. Total screen management. Save program development time. Distributed w/source code & several other programs. \$19.95.

KARL THOMPSON  
108-28 63rd Ave.  
Forest Hills, NY 11375  
(212) 896-4624

## DEBUGGER/SOURCE INCLUDED

A debugger with FULL SCREEN format and SCREEN COEXISTENCE with test program (including graphics—even SCROLLS THROUGH LISTING FILES without disturbing the test session—all with NO COMMANDS and only 10 function keys! It's fast (assembler), small (60K), and only \$75 with manual and includes the source. DOS 2.X IBM PC.

PC-TEST

for the software developer

P.O. Box 54068

San Jose, CA 95154

## SOFTWARE/ ENGINEERING

### PELADA TEXT ENGINEER

Engineering and Scientific Word processing. Technical symbols, special characters, super/subscripts, italics, underlining, bolding. With graphics hardware you can design any symbols you want, up to 384 different characters. All characters visible on screen and printable. Easy English commands. \$250.  
PELADA INFORMATICS INC.  
562 Johnson Street  
Kingston, Canada K7L-2A1  
(613) 549-1747

## ELECTRONIC CIRCUIT ANALYSIS

ECA is a high performance simulator for analog electronic circuits. Features include full editing, worst case, sensitivity analysis, ability to sweep components, 64 nodes. It is easy to use and very fast. Price \$150. For all MS-DOS, CP/M, CP/M-86 computers.

TATUM LABS

P.O. Box 698

Sandy Hook, CT 06482

(203) 426-2184

## HEAT TRANSFER ON THE PC

T/SNAP AND CPP1 are Thermal Engineering Programs. T/SNAP will solve steady-state and transient problems up to 250 nodes. Includes interactive input, FSE and plotting. CPP1 will design various size coldplates using compact fins. Calculates parametric electronic heat sink and pressure drop performance.

TECHNA/SOFT SYSTEMS

717 W. 14th Street

Long Beach, CA 90813

(213) 432-2704/823-6291

## PC ENHANCEMENT HANDBOOK

THE IBM PC ENHANCEMENT HANDBOOK for SCIENTISTS & ENGINEERS. A How-To-Handbook with answers to all of your questions on PC enhancement. What can be done? How to do it? And How much will it cost? Includes Toll Free Hotline for application assistance & convenient one stop shopping. SPECIAL INTRODUCTORY OFFER \$18.95.

CyberResearch, Inc.

P.O. Box 9565

New Haven, CT 06536

(800) 341-2525; (203) 436-2600 (CT)

## SOFTWARE GENERAL

### ATTENTION SOFTWARE AUTHORS

Our established literary agency is seeking to represent talented freelance programmers. We open doors for our clients at the leading software houses and negotiate the best deal possible. Put our years of experience to work for you. For further information on the benefits of representation contact:

THE ROBERT JACOB AGENCY  
1642 Eveningside Drive, Suite 110  
Thousand Oaks, CA 91362  
(805) 492-3597

### RENT PUBLIC DOMAIN SOFT/W

Rent our PC Disk Libraries for 7 days and copy them yourself. Hundreds of useful business, games and utilities FREE FOR THE TAKING!

IBM-PC SIG-135 Disks \$135.00

IBM-PC "Blue" 53 Disks \$50.00

Rental is for 7 days after receipt, 3 days grace to return. Most credit cards accepted.

NATIONAL PUBLIC DOMAIN  
SOFTWARE CENTER

1533 Avohill Drive

Vista, CA 92083

(619) 941-0925. Info-(619) 727-1015. 24 hr. orders.

## SOFTWARE/GRAPHICS

### GEOGRAF™

GEOGRAF™ helps you prepare high-quality, customized graphs for business, engineering and science. GEOGRAPH™ cuts programming time by up to 80%. Callable from BASIC, FORTRAN or PASCAL. Versions available for most graphics cards and plotters. Fully compatible with Colcomp's FORTRAN standard plotting package.

GEOCOMP CORPORATION

342 Sudbury Road

Concord, MA 01742

(617) 369-8304

### PRESS 'N' PLOT 2.0

Insert images into your text for correspondence that counts. Capture screen images from most graphics programs and merge them with text from most word processors. Can automatically wrap the text around the image. Supports most popular color or B-W dot matrix printers. \$149. AMERICAN PROGRAMMERS GUILD, LTD.

55 Mill Plain 17-5

Danbury, CT 06811

(800) 828-8088; in CT, (203) 794-0396

### GRAPHICS LIB FOR TECMAR

TEK-MAR lets you do high-res graphics on your TECMAR Graphics Master. TEK-MAR is a library for use with MS Fortran. Features windowing, viewporting, clipping, axis rotation. Similar to Tektronix graphics. Includes screen dump/restore, Epson screen print, support for (Western Graphtec plotter. Requires MS-FORT 3.20, 320K, GMDEV.SYS (5.2). Price: \$195.

ADVANCED SYSTEMS CONSULTANTS

18653 Ventura Boulevard, Suite 351

Tarzana, California 91356

(818) 990-4942

### TEKTRONIX 4010 EMULATION

High resolution screen/printer graphics for the IBM PC. Full interactive capabilities with file transfer and cross-hair control. Utilizes PLOT 10, protocols. OFF-line review of graphics output. Supports IBM color/graphic or Hercules cards. Easy to use 4010 emulation at an affordable price. \$80.00. Demo disk \$5.

Technological Systems Group

5044 Haley Court

Lilburn, GA 30247

(404) 923-4980



# TECH MART

## FORTRAN OR PASCAL PROGRAMMER?

READ  
THIS  
AD



### GRAPHICS

- Text/graphics generics
- 2D interactive
- 2D plots (full support) including auto-scaling, auto-axis generation, auto-labeling, tabular/log/parametric curves, splines, bars, pies, you name it, we have it.
- 3D Plots incl. 2 hidden line removal options—not just old-fashioned wire frame.

### PEN PLOTS

- Standard plotter primitives plus
- FULL 2D support plus
- Interface to screen graphics,
- Limited 3D.

Clear and complete documentation.

**GRAFATIC** \$135.  
**PLOTMATIC** 135.

### MICROCOMPATIBLES

11443 Oak Leaf Drive  
Silver Spring, MD 20901  
(301) 593-0683

CIRCLE 301 ON READER SERVICE CARD

# FREE DATABASE

MANAGEMENT SYSTEM  
PROGRAMMABLE RELATIONAL FULL  
VERSION NOT A DEMO

- Form Generator
- Subrecords
- Numeric Ranges
- Subtotals
- 3 Files Open Simultaneously
- Global Field Changes
- Key strings to numbers
- Real time transfers between files
- Manual is on disk
- Written in Basic for modification
- Over 15,000 Lines of Source Code Given
- Accounting, Payroll, inventory, A/R sample Applications
- for IBM PC with 128K
- Compatibles with 192K & Microsoft Basic • Mail Today for early delivery
- Report Generator
- Customizable Screens
- ASCII Output
- Tax Tables
- Menu Driven
- Creates Subfiles
- Sort on 3 Fields
- Recalculate Files
- 14 Ways to Calculate Fields
- Transfer Data between files
- No royalties on applications
- Retrieve on conditions for each field
- A "user supported" program
- Much More
- PC Jr. with 128K & Cartridge Basic

**POTOMAC PACIFIC ENGINEERING INC.**  
Box 2027, Gaithersburg, MD 20879 (301) 977-1489

- Copy the system from someone who already has one OR
  - Send \$10. to cover the cost of 2DD50 disks (or 2 floppy disks)
  - 1st class mail, envelope, copying & handling.
- Please send the data base to:
- Name \_\_\_\_\_  
Street \_\_\_\_\_  
City, State, Zip \_\_\_\_\_

## ICs PROMPT DELIVERY!!! SAME DAY SHIPPING (USUALLY)

**64K DYNAMIC RAM ICs**  
200 ns \$4.87, 150 ns \$4.87

**256K DYNAMIC RAMS**  
150 ns @ \$35.77


Add 512K into XT or PPC @ \$647!  
With our proprietary Information kit  
Increase motherboard memory to 640 Kbyte!  
CONSUME 0 EXPANSION SLOTS!

**SPECIAL: 64K 150 ns @ \$4.44**  
CONDITIONS: (1) Phone to confirm current price (2) Quantity: multiple of 24 or 25 (3) Prepaid, No Cancellations (4) Delivery 10 to 21 days (5) \$10. shipping & handling (6) shipping insurance 30c per \$100.

**We Sell Other Memory ICs.**  
6264, 2764, 27128, 27256, etc.

Open 6 1/2 days: we can Ship via Fed-Ex on Sat.

MasterCard/VISA or UPS CASH COD

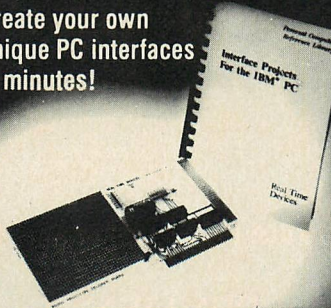
**Factory New, Prime Parts** 

**MICROPROCESSORS UNLIMITED**

24,000 South Peoria Ave. (918) 267-4961  
BEGGS, OK. 74421

Prices shown above are for July 30, 1984.  
Please call for new discount & current prices. Prices subject to change. Please expect higher prices on some parts due to world wide shortages. Shipping and Insurance extra. Cash discount prices shown. Small orders received by 6 PM CST can usually be delivered to you by the next morning, via Federal Express Standard Air @ \$5.99!

## Create your own unique PC interfaces in minutes!



The PD100 allows rapid development of specialized PC interfaces. It features a buffered data bus, switch-selectable address decoder, and a large prototype area (up to 40 IC sockets). The 116-page manual covers basic interfacing concepts and details implementing A/D, D/A converters, I/O ports, connection of transducers and dozens of useful circuits.

PD100 w/ manual - \$99 plus \$3.50 P&H  
Manual only - \$20 Postpaid  
PA residents add 6%  
Check, MasterCard, or VISA (814) 234-8087

**REAL TIME DEVICES**  
1930 Park Forest Ave.  
P. O. Box 906  
State College, PA 16804

# SALES POWER

PC: Tech Journal not only sells itself at a nice profit, it helps sell the hardware and software in your store too. Because it goes home with customers and continues to influence buying decisions long after you're closed for the day. Let's talk now.

**CALL COLLECT:**  
**(212) 725-7679**

Or write:  
☐ Ziff-Davis Publishing  
One Park Avenue  
New York, NY 10016



Minimum order, 10 copies. We pay all shipping costs.

# SAVE

## ON GROUP AND CORPORATE SUBSCRIPTIONS

If you're part of a user group or a group of people who use an IBM PC, PCXT, PCjr or compatible in the office or at school, you may be eligible for discounts to the world's leading IBM PC publications!

For more information, have a representative contact Dan Rosensweig at 212-503-5354

Ziff-Davis Publishing Company  
One Park Avenue—4th Floor  
New York, NY 10016



 The Independent Guide To IBM Personal Computers

## PCDISK

New Programs on  
Diskette for the IBM  
PC, PCXT, PCjr and  
most Compatibles

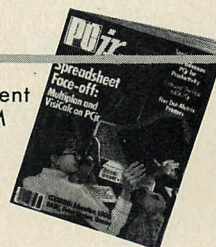


## TECH JOURNAL

For Advanced  
IBM PC users.

## PCjr.

The Independent  
Guide To The IBM  
PCjr In Educa-  
tion, Home and  
Business





# —PRESENTING—

## The first compiler for dBASE II®



WordTech Systems is proud to announce the first compiler for dBASE II®.

### —INDEPENDENCE—

Now you can write compiled, efficient programs that will execute independently of dBASE II, and without RunTime®.

### —NO LICENSE FEES—

You only buy dB Compiler™ once. You may compile as many applications as you wish, FOREVER, with no additional fees.

### —SPEED—

Application programs are compiled into low level code and only include program functions that are absolutely necessary.

### —SECURITY—

Compilation is far better than encryption for protecting your programming insights and procedures.

### —PORTABILITY—

Using dB Compiler's cross-linkers you can use one development system to generate code for various target environments.

Suggested retail price: \$750; additional target modules: \$350

CIRCLE NO. 197 ON READER SERVICE CARD

## **dB**COMPILER™

WORDTECH SYSTEMS P.O. Box 1747, Orinda, CA 94563 (415) 254-0900

dBASE II, RunTime® Ashton-Tate

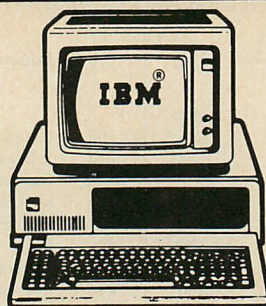


# PC TECH JOURNAL PRODUCT INDEX

RS#	PRODUCT	ADVERTISER	PAGE #	RS#	PRODUCT	ADVERTISER	PAGE #
OPERATING SYSTEMS				COLOR MONITORS			
191	Xenix	The Santa Cruz Operation, Inc.	191	188	Princeton HX-12	Princeton Graphics	167
GRAPHICS SOFTWARE				ACCESSORY CARDS/ MULTIFUNCTION BOARDS			
184	Plotcall	Golden Software	180	106	Crambo Cards	Apparat, Inc.	90-91
163	G Graphics Editor	Micro Marketing Associates	172	130	Solidisk	Fastore	33
203	Z-Soft	Z-Soft	43	133	Colorcard	Hercules Computer Technology	C-4
SOFTWARE FOR PROFESSIONALS				168	Mr Chips	Orange Micro	7
192	APX Core	Application Executive Corp.	135	190	Bubble Memory	Pure Data Ltd	109
110	Cross Assembler	Avocet Systems Inc.	190	201	B-Trieve	Softcraft	173
*	Sidekick	Borland International	C-2	176	Analog Connection PC	Strawberry Tree	42
235	Printer Basher	Connecticut Software	186	209	Lab Pac	Tecmar Inc	171
170	Software	PC Brand (PC Annex)	150-151	227	PC Turbo	Orchid Technology	20
212	Statistical & Report	S.P.S.S.	179	NETWORKING PRODUCTS			
WORD PROCESSING SOFTWARE				198	Multilink	Software Link	149
135	Display Write	IBM	92-93	195	Elan	Tecmar Inc	18-19
171	Editor-N-Chief	Polygon Software Corp.	29	218	Network Station	Watsoft Products Inc	138
236	Word Perfect	Satellite Software Int'l	123	OTHER ACCESSORY CARDS			
LANGUAGES				107	PC Probe	Atron	49
104	Gauss	Applied Technical System	134	120	Concepts 100	Concept Technologies, Inc.	163
*	Turbo Pascal	Borland International	C-2	151	Monochrome Card	Hercules Computer Technology	9
116	Basic C	C-Source	140	MASS STORAGE HARDWARE			
214	Desmet	C-Ware	218	106	Apparat Harddisk	Apparat, Inc.	90-91
129	C-86 Compiler	Computer Innovations	44	111	Teammate	Data Technology Corp.	28
222	HS/Forth	Harvard Softworks	201	144	Disk Drive	Dragon Industries	75
243	Lisp	Integral Quality	184	124	9-Track Mag	Ibex Computer Corp	134
159	PC/Forth	Laboratory Microsystems	158	149/			
186	Coherent	Mark Williams Co, The	27	205	10 MB Drive	Interface Inc.	48
165	MBP Cobol	mbp Software and Systems		102	Bernoulli Box	Iomega	125
		Technology	97	200/			
143	Professional Pascal	Micro Tec Research	192	225	Mega Flight 100	Kammerman Labs	25
*	Pascal	Microsoft Inc	87	134	Data Series	Micro Design	83
*	Fortran	Microsoft Inc	89	227	9 Track Tape Backup	Overland Data, Inc.	138
*	Cobol C	Microsoft Inc	85	169	The Vision Series	Pacific Datanet, Ltd.	39
177	Better Basic	Summit Software	99-101	224	Hard Diskards	Qubie Distributing	170
181	TBasic	Transera Corp.	116	*	The Image	Sysgen, Inc.	41
DATA BASE MANAGEMENT SOFTWARE				234	Tallgrass Harddisk	Tall Grass Technologies	2
300	D Base II	Ashton Tate	152-153	COMMUNICATIONS HARDWARE			
146	Dataflex	Data Access Corp	105	221	Omninet	Corvus Systems	159
217	Dayflo	Dayflo Software	78-79	278	Multilink	Davong Systems	C-3
119	C-Tree	Faircom	74	187	Xcom Modem	Delta Communications	143
219	MDBS III	Micro Data Base Systems		210	IRMA	Digital Commun. Assoc.	10-11
		Inc.	114-115	213	File Connection	Flagstaff Engineering	113
118	Knowledge Man	Micro Data Base Systems Inc.	13	158	Smartcom 11	Hayes Microcomputer Products	76-77
156	Power-Base	Powerbase Systems	168-169	136	Idea Comm 3278	Ide Associates	34-35
148	Zim	Zanthe	1	204	MT212PC Board Modem	Multi Tech Systems	8
PROGRAMMERS TOOLS				103	Smart-Cat Modem	Novation Inc.	141
157	B-Tree	Accudata Software	160	ADDITIONAL SUPPLIES			
166	Amerisoft Edit Tool	Amerisoft	158	138	Supplies	INMAC Corp	130
206	PDT-PC	Answer Software	132	220	Readiscope	Readiware	196
114	ESP	Bellesoft, Inc.	31	178	TDK Diskettes	TDK Electronics Corp.	110-111
115	Pascal and C Tools	Blaise Computing	106	SOFTWARE UTILITIES			
113	C Systems C	C-Systems	86	153	Multijob	B & L Computer Consultants	200
173	Explain Document	Communication Sciences, Inc.	119	112	RTool	Bit Wit Software	162
121	Windows For C	Creative Solutions	137	108	Visual Shell	Bourbaki, Inc.	128
131	Debugger	D & V Systems Inc.	119	223	California 10 Pak	California Software Products	182
137	Peeks'n Pokes	Data Base Decisions	166	122	Power	Computing!	156
216	The Profiler	DWB Associates	128	155	3740 File Conversion	Micro Tech Exports	4
109	Microstat	Ecosoft Inc.	130	179	Opt-Tech Sort	Optimum Data Processing	4
105	The Greenleaf Funct.	Greenleaf Software	124	196	Opt Tech Scroll	Optimum Data Processing	136
128	C-Compilers	Lattice, Inc.	172	141	Text Engineer	Pelada Informatica	139
145	Micro Ed/Script	Micro Type	136	194	Copywrite	Quaid Software	160
167	Mylstar Symbolic Deb	Mylstar Electronics	108	150	Key Swap	Rickerdata	21
154	Plink 86	Phoenix Software Associates	15	*	Jet	Tall Tree Systems	104
156	Polymake	Polytron	168-169	172	Screen Sculpture	The Software Bottling Co. of NY	194
207	SPF/PC/The Add Coupl	Rouge River Software	122	164	Dflow	Wal Soft Systems Inc.	120
162	Set:Skill	Set (Systems Engineering Tools	183	MAIL ORDER			
161	Toolkits	Seven Valleys Software	147	117	Compumail		216
132	Firsttime	Spruce Technology	185	125	Creative Microsales		102
299	X-Shell	Standard Datacom, Inc.	107	129	Eastern Enterprises		103
208	APL/Plus PC	STSC	157	139	Lifboat Assoc.		198-199
180	Prolock	Vault Corporation	16-17	174	Microway		98
140	Codesmith-86	Visual Age	142	123	Microxpress		84
228	Fullscreen Editor	Watsoft Products Inc	33	182	PC Connection		52-53
192	DB Compiler	Wordtech	214	183	PC Link		113
IBM COMPUTERS AND COMPATIBLE UNITS				226	Programmers Connections, Inc.		112
*	Compaq Deskpro	Compaq Computer Co.	174-175	175	Software Horizons (Novum Org)		46
277	Single Board PC	I-Bus Systems	88	239	Programmer's Shop		47
152	Develop a Program	IBM	50-51	160	Programmer's Shop		164



AMERICA'S NO. 1  
**IBM® Systems Specialists**



## IBM PC \$1899

256K, two disk drives 360K each,  
Drive Controller and Keyboard

## IBMPC w/10MB

256K, one floppy Drive, Keyboard  
10 MB Hard Disk with Controller

**\$2599**

BOOTS FROM HARD DISK Backup also available

## IBMPCw/30MB

256K, one floppy Drive, Keyboard  
30 MB Hard Disk with Controller  
and Booster Power Supply

**\$3999**

BOOTS FROM HARD DISK Backup also available

# ★ PRICE WAR ★ CALL US LAST WITH YOUR BEST QUOTES ★

PRINTERS	HARD DRIVES	NETWORKING
<b>EPSON</b> FX-80 ..... \$429 FX-100 ..... \$649 LQ-1500 ..... \$1,099 <b>OKIDATA</b> 92P ..... \$399 93P ..... \$619 INCLUDES PLUG & PLAY 84P ..... \$749 2050 ..... \$799 <b>NEC</b> 3550 ..... \$1,499 PINWRITER P2 and P3 ..... CALL <b>DYNAX DX-15</b> \$399 Keyboard ... \$149 Tractor ... \$99 Sheet Feeder ... \$199 <b>BROTHER</b> HR-25 ... \$649 HR-35 ... \$999 Tractor ..... \$119 Cut Sheet Feeder ..... \$199 DATA PRODUCTS <b>IDS PRISM</b> COLOR PRINTER 80 ..... \$999 132 ..... \$1199 OPTIONS ..... CALL <b>ANADEx • DIABLO</b> <b>QUME • TOSHIBA</b> CALL	<b>UP TO 140 MB</b> BACKUP ALSO AVAILABLE CALL <b>EVEREX 10MB</b> w/Controller and 2 Year Warranty <b>\$899</b> <b>MAYNARD 10MB/30MB</b> 10MB/WS-1 ..... \$899 10MB/WS-2 ..... \$999 30MB/WS1A .. \$2395 30MB/WS-2A .. \$2495 <b>TALL GRASS TECHNOLOGY</b> <b>20 MB</b> w/20 MB Backup ..... \$3,299 <b>35 MB</b> w/45 MB Backup ..... \$4,495 <b>70 MB</b> w/60 MB Backup ..... CALL <b>FLOPPY DRIVES</b> <b>TEAC</b> HALF 55B-DSDD ..... \$149 HEIGHT 55F-QUAD ..... \$199 Full Ht. DSDD ..... \$199 <b>CDC</b> Half Ht. DSDD ..... \$179 <b>TANDON 100-2</b> \$179 Full Ht. DSDD	<b>ORCHID TECHNOLOGY</b> PC Net PLUS Starter Kit ..... \$999 PC netBlossom, PC turbo, PC netPlusRam ..... CALL <b>CORVUS OMNINET</b> CALL FOR YOUR CONFIGURATION AND PRICES <b>SANTA CLARA SYSTEMS</b> PC Terminal ..... CALL <b>MULTI-DISPLAY CARDS</b> <b>PERSYST</b> Mono OR Color ..... \$199 BOB Mono and Color ..... CALL Profit Systems <b>MULTIGRAPH</b> CALL <b>EVEREX</b> Graphics Edge <b>\$399</b> <b>TECMAR</b> Graphics Master <b>\$449</b> <b>HERCULES</b> Mono Graphics ..... \$329 Color Graphics ..... \$199 NEW <b>STB</b> Graphix Plus II <b>\$349</b> <b>PLANTRONICS</b> Color Plus <b>\$366</b> <b>PARADISE</b> Multi-display Card <b>\$299</b> <b>EVEREX</b> Color & Mono Cards CALL <b>MULTI-FUNCTION CARDS</b> NEW <b>QUADBOARD</b> 0-K (to 384K) <b>\$199</b> <b>AST SIX PAK</b> with 64K (to 384K) <b>\$249</b> <b>EVEREX</b> Magic Card w/software 0-K (to 384K) <b>\$229</b> <b>MISC. ADD ONS</b> <b>8087 CHIP</b> <b>\$159</b> <b>CABLE</b> Parallel ..... \$20 Serial ..... \$25 <b>IBM PC</b> Keyboard (original) <b>\$99</b> <b>IBM PC</b> Floppy Drive Controller <b>\$99</b> <b>COMPUTER POWER</b> P2 \$109 <b>ACCESSORIES DIRECTOR</b> P12 \$149 <b>STANDBY</b> 200 WATTS.....\$279 <b>POWER SUPPLY</b> 300 WATTS.....\$379 Surge Protection, up to 30 minutes Standby Power
<b>AMDEK</b> <b>AMPLIT II - 6 Pens</b> <b>\$799</b> <b>HEWLETT</b> 7470A - 2 Pens ..... \$949 <b>PACKARD</b> 7475A - 6 Pens ..... \$1,699 <b>ROLAND</b> DXY-101 - 1 Pen ..... \$599 DXY-800 - 8 Pens ..... \$799 <b>houston</b> DMP 40 - 2 Pens ..... \$799 <b>instrument</b> DMP 29 - 8 Pens ..... \$1799 <b>MONITORS</b> MAX-12 Amber ..... \$179 <b>PGS</b> HX-12 ..... \$449 SR-12 ..... \$599 <b>TAXAN</b> COLOR & MONOCHROME ..... CALL 310A.....\$159 • 300A.....\$139 • 300G.....\$119 <b>AMDEK</b> COLOR MONITORS .. CALL <b>MODEMS</b> <b>MICROCOM ERA 2</b> \$349 PC Internal 1200 Baud w/software, 4 Yr. Warranty <b>HAYES</b> 1200B w/software \$399 <b>SMARTMODEM</b> 1200 ..... \$479 <b>QUBIE</b> Standalone ..... \$329 Internal ..... \$299 <b>POPCOM</b> Internal or Standalone ..... CALL	<b>64K RAM</b> \$45 Set of 9 chips <b>HAYES</b> 1200B w/Software ..... \$399 <b>SMARTMODEM</b> 1200 ..... \$479 <b>PGS SR-12</b> <b>\$599</b> <b>OKIDATA</b> 92P ..... \$399 93P ..... \$619 INCLUDES PLUG & PLAY 84P ..... \$749 <b>KEYTRONIC</b> \$199 Deluxe Keyboard KB5151 <b>BROTHER</b> HR-25 (23CPS) ..... \$649 HR-35 (36CPS) ..... \$999 <b>P.O. &amp; FOREIGN ORDERS</b> CALL FOR DETAILS NO SURCHARGE ON COD, VISA/MC	



# INDEX TO ADVERTISERS

READER SERVICE NUMBER	ADVERTISER	PAGE	READER SERVICE NUMBER	ADVERTISER	PAGE	READER SERVICE NUMBER	ADVERTISER	PAGE
157	Accudata Software.....	160	130	Fastore.....	33	170	PC Brand .....	150-151
101	Advanced Programming Tech .....	164	213	Flagstaff Engineering.....	113	182	PC Connection .....	52-53
166	Amerisoft .....	158	184	Golden Software .....	180	183	PC Link .....	113
206	Answer Software .....	132	105	Greenleaf Software .....	124	147	PC Performance .....	162
106	Apparat.....	90-91	222	Harvard Softworks.....	201	169	Pacific Datanet.....	39
192	Application Executive Corp.....	135	158	Hayes Microcomputer ....	76-77	141	Pelada Informatica.....	139
104	Applied Technical System	134	151	Hercules .....	9	154	Phoenix Software.....	15
300	Ashton Tate .....	152-153	133	Hercules .....	C4	171	Polygon.....	29
107	Atron .....	49	124	IBEX Computer Corp .....	134	268	Polytron.....	129
110	Avocet .....	190	277	I-Bus Systems .....	88	156	Powerbase Systems .....	168-169
153	B&L Computer .....	200	152	IBM.....	50-52	188	Princeton Graphics.....	167
114	Bellesoft.....	31	135	IBM.....	92-93	226	Programmer's Connection	112
112	Bit Wit Software.....	162	136	IDE Associates .....	34-35	239	Programmer's Shop.....	47
115	Blaise Computing.....	106	138	Inmac.....	130	160	Programmer's Shop.....	164
*	Borland International.....	C-2	243	Integral Quality .....	184	190	Pure Data LTD. ....	109
108	Bourbaki, Inc. ....	128	149/			194	Quaid Software .....	160
116	C-Source.....	140	205	Interface .....	48	224	Qubie Distributing.....	170
113	C-Systems .....	86	102	Iomega .....	125	220	Readiware.....	196
214	C-Ware/DeSmet C .....	218	200/			150	Rickerdata .....	21
223	California Software Products .....	182	225	Kammerman Labs .....	25	207	Rogue River Software.....	122
173	Communication Sciences...	119	159	Laboratory Microsystems...	158	212	SPSS.....	179
*	Compaq Computer Co. 174-175		128	Lattice, Inc. ....	172	208	STSC .....	157
117	Compumail .....	216	139	Lifeboat Associates .....	198-199	191	Santa Cruz Operation.....	191
129	Computer Innovations .....	44	186	Mark Williams Co., The ....	27	236	Satellite Software .....	123
122	Computing!.....	156	165	mbp Software and Systems Technology.....	97	161	Seven Valley Software.....	147
120	Concept Technologies.....	163	118	Micro Data Base Systems.....	13	201	Softcraft .....	173
235	Connecticut Software .....	186	219	Micro Data Base Systems.....	114-115	172	Software Bottling Co. ....	194
221	Corvus .....	159	134	Micro Design Int'l.....	83	175	Software Horizons .....	46
125	Creative Microsales .....	102	163	Micro Marketing Associates.....	172	198	Software Link.....	149
121	Creative Solution .....	137	143	Micro Tec Research .....	192	132	Spruce Technology.....	185
131	D & V Systems .....	119	155	Micro Tech Exports .....	4	299	Standard Datacom .....	107
210	DCA.....	10-11	145	Micro Type.....	136	176	Strawberry Tree.....	42
216	DWB Associates .....	128	*	Microsoft .....	85	177	Summit Software .....	99-101
146	Data Access Corp.....	105	*	Microsoft .....	87	*	Sysgen, Inc. ....	41
137	Data Base Decisions.....	166	*	Microsoft .....	89	162	Systems Engineering Tools	183
126	Data Decisions .....	131	174	Microway .....	98	178	TDK Electronics.....	110-111
202	Data Sources.....	176	*	Microware... See Microway		234	Tall Grass Technology .....	2
111	Data Technology Corp.....	28	123	Microxpress.....	84	*	Tall Tree Systems.....	104
278	Davong Systems.....	C-3	204	Multi Tech Systems.....	8	195	Tecmar .....	18, 19
217	DayFlo Software .....	78-79	167	Mylstar Electronics .....	108	209	Tecmar .....	171
187	Delta Communications .....	143	103	Novation .....	141	181	Transera .....	116
144	Dragon Industries.....	75	179	Opt-Tech .....	4	180	Vault Corporation.....	16-17
129	Eastern Enterprises .....	103	196	Opt-Tech .....	136	140	Visual Age.....	142
109	Ecosoft .....	130	168	Orange Micro.....	7	164	Wallsoft Systems, Inc.....	120
119	Faircom.....	74	227	Orchid Technology .....	20	218	Watsoft .....	138
			185	Overland Data.....	138	228	Watsoft .....	33
						197	Word Tech.....	214
						203	Z-Soft .....	143
						148	Zanthe .....	1



# DeSmet C

**8086/8088  
Development  
Package \$109**

## FULL DEVELOPMENT PACKAGE

- Full K&R C Compiler
- Assembler, Linker & Librarian
- Full-Screen Editor
- Execution Profiler
- Complete **STDIO** Library (>120 Func)

## Automatic DOS 1.X/2.X SUPPORT

## BOTH 8087 AND SOFTWARE FLOATING POINT

## OUTSTANDING PERFORMANCE

- First and Second in AUG '83 BYTE benchmarks

## SYMBOLIC DEBUGGER \$50

- Examine & change variables by name using C expressions
- Flip between debug and display screen
- Display C source during execution
- Set multiple breakpoints by function or line number

## DOS LINK SUPPORT \$35

- Uses DOS .OBJ Format
- LINKs with DOS ASM
- Uses Lattice® naming conventions

Check: ☐ Dev. Pkg (109)  
☐ Debugger (50)  
☐ DOS Link Supt (35)

SHIP TO: \_\_\_\_\_

ZIP \_\_\_\_\_

**CWARE**  
CORPORATION

P.O. BOX C  
Sunnyvale, CA 94087  
(408) 720-9696

All orders shipped UPS surface on IBM format disks.  
Shipping included in price. California residents add sales tax. Canada shipping add \$5, elsewhere add \$15. Checks must be on US Bank and in US Dollars. Call 9 a.m. - 1 p.m. to CHARGE by VISA/MC/AMEX.

## CALENDAR

### OCTOBER

October 2-4

#### East Coast Computer Faire Boston, MA

Sponsor: Computer Faire, Inc.  
Contact: Dave Roth, 617-965-8350  
(East Coast office); Nels Anderson,  
415-364-4294 (West Coast office)

October 8-10

#### ACM 1984 Conference San Francisco, CA

Contact: Karen A. Duncan, Health  
Information Systems, 15 Parsons Way,  
Los Altos, CA 94022, 415-948-3941

October 9-11

#### International Conference on Advances in Microprocessor Peripherals

Lausanne, Switzerland  
Contact: Secretariat des Journées  
d'électronique et de microtechnique,  
Département d'Electricité—EPFL,  
Chenin de Bellerive 16, CH-1007,  
Lausanne, Switzerland, 41-21-471111

October 15-17

#### 4th Symposium on Reliability in Distributed Software and Database Systems Silver Spring, MD

Sponsor: IEEE Computer Society,  
in cooperation with ACM  
Contact: IEEE Computer Society,  
P.O. Box 639, Silver Spring, MD 20901,  
301-589-8142

October 15-18

#### SOFTCON/FALL Los Angeles, CA

Sponsor: Northeast Expositions  
Contact: Northeast Expositions,  
617-739-2000

October 16-18

#### UNIX EXPO New York, NY

Sponsor: UNIGROUP of New York  
Contact: National Expositions Co., Inc.,  
14 West 40th Street, New York, NY  
10018, 212-391-9111

October 25-28

#### Philadelphia/Userfest Philadelphia, PA

Sponsor: Northeast Expositions  
Contact: Northeast Expositions,  
617-739-2000

October 25-28

#### Twin Cities Computer Show and Software Exposition Minneapolis, MN

Sponsor: CompuShows, Inc.

Contact: CompuShows, Inc., P.O. Box  
3315, Annapolis, MD 21403,  
301-269-7694

October 29-November 1

#### COMDEX/Europe/84 Amsterdam, The Netherlands

Contact: The Interface Group, 300 First  
Ave., Needham, MA 02194

### NOVEMBER

November 1-4

#### Seventh Annual Northeast Computer Show Boston, MA

Sponsor: Northeast Expositions  
Contact: Northeast Expositions,  
822 Boylston Street, Chestnut Hill, MA  
02167, 617-739-2000

November 5-9

#### Eighth International Computer Software and Applications Conference (Compsac 84) Chicago, IL

Sponsor: IEEE  
Contact: Nick Marselos, AT&T  
Technology, 2600 Warrenville Rd.,  
Lisle, IL 60532, 312-260-4104

November 12-15

#### IEEE International Conference on Computer-Aided Design Santa Clara, CA

Sponsor: IEEE  
Contact: William J. McCalla, Hewlett-  
Packard Co., 11000 Wolfe Rd.,  
Cupertino, CA 95014, 408-257-7000,  
ext. 2225

November 30-December 2

#### Bits & Bytes, the First National Computer Experience for Kids Anaheim, CA

Sponsor: Information Processing Group  
Contact: Maryse Najar or Roger Fischer  
of Pollare/Fischer Communications,  
213-478-0995

### DECEMBER

December 6-8

#### 1984 Real Time Systems Symposium Austin, TX

Sponsor: IEEE  
Contact: Miroslaw Malek, University of  
Texas at Austin, Computer Science  
Department, Austin, TX 78712,  
512-471-5704



# The Perfect Match



**Davong** has a beautiful way to solve both your hard disk storage and backup needs.

**Davong combines good looks with hard disk and tape.**

Our new DataSystem for IBM® PCs.

We offer a full range of disk sizes, all including a hard disk drive plus tape backup unit. And the capability of using the tape as a start/stop systems device.

In fact, this Davong DataSystem has a lot of other beautiful benefits, too. Like compressed or full-volume backup with file-by-file or full-volume restore. And automatic flaw mapping to ensure complete media interchangeability.

Our full XT compatibility actually offers performance a cut above other XTs. And if you want even higher performance and password protection, you can use our Multi-OS® software.

To top it off, there's the sleek, contemporary styling of our DataSystem. And a low price that's equally attractive.

**Davong  
DataSystem  
for IBM  
PC's.**



®Multi-OS is a registered trademark of Davong Systems, Inc.    ®IBM is a registered trademark of IBM Corp.

Davong Systems, Inc.  
217 Humboldt Court  
Sunnyvale, CA 94089  
(408) 734-4900 Telex: 176386

CIRCLE NO. 278 ON READER SERVICE CARD



# The new HERCULES<sup>™</sup> Color Card gives you the parallel port IBM<sup>®</sup> forgot—for \$1 more.



## And it fits into the XT's short slot.

The new Hercules Color Card gives you these five important features in a color graphics card.

1. A parallel printer port. If you buy IBM's color card, you won't get a parallel port for a printer. Ugh. You've just wasted a valuable slot for an extra printer card.

2. It's short. Our new Color Card uses advanced gate array technology to reduce the chip count by 30 and use less than half the board space IBM does. Which makes the new Hercules Color Card perfect for the short slot in an XT.

3. Fully IBM compatible. Any program that runs on IBM's color card will run on the new Hercules Color Card. With RGB or composite video, any IBM compatible monitor will work too.

4. Hercules Graphics Card compatible. If you have a Hercules Graphics Card (model GB101 or later), or plan to buy one, an ingenious software switch on our new Color Card allows both cards to be kept in the system at the same time.

5. Low price. At a suggested list price of \$245, the new Hercules Color Card has all these features for only \$1 more than IBM's color card.



Call for our free information kit. See why the company that made the first graphics card for the IBM PC still makes the best.

**Hercules. We're  
strong on graphics.  
800 255 5550 Ext. 423**

CIRCLE NO. 151 ON READER SERVICE CARD

Address: Hercules, 2550 Ninth St, Berkeley, CA 94710 Ph: 415 540-6000 Telex: 754063 Features: 2 year warranty Foreign distributors: Compuserve/Canada; Reflex/U.K.; Computer 2000/W. Germany; Edisoft/France; SourceWare/Australia. Trademarks/Owners: Hercules/Hercules Computer Technology; IBM/International Business Machines.  
This price comparison is based on the Suggested List Price as of 2.22.84 for the IBM Color Graphics Adapter.